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# WILDLIFE LABORATORY

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Montana Department of
Fish, Wildlife & Parks

# JOB PROGRESS REPORT

State: Montana

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| Project No.: W-120-R-15 | Project Title: | Statewide Wildlife Research |
| Element No.: VI | Element Title: | Wildlife Investigations Laboratory |
| Sub-project No.: 2 | Sub-project Title: | Research and Technical Services |
| Study No.: Wl-1.0 | Study Title: | Wildlife Laboratory |
| Job No.: 1 | Job Title: | Statewide Wildlife Laboratory Services |

Period Covered: July 1, 1991 - 1992

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Since this is a progress report only, results presented herein are not necessarily final and may be subject to change. For this reason, the information contained in this report may not be published or used for other purposes without permission of the Director.

## ABSTRACT

The Wildlife Laboratory processed 200 general wildlife specimens and 600 hunter/trapper specimens. Approximately 500 big game and furbearer samples were analyzed for food habits. Blood samples from over 1300 animals of several species were analyzed for disease and chemistry profiles. Blood serum and reproductive tracts from 400 animals of several species were analyzed for reproductive performance. Approximately 400 skulls were processed. Over 800 teeth were processed for age determination by cementum annuli counts. Ages were determined for 200 bobcat and 270 mountain lion. Tests were conducted on aging techniques for these two species. Biological measurements, blood, and tissue were collected from bison harvested during the 1991-92 season. Tissue and blood samples were collected from 225 elk in three elk herds in Region 3 to test for various diseases. Sixty-eight animal necropsies were conducted on a variety of species. A total of $23,148 was grossed during the sale of 162 hides, heads, and other items auctioned in the annual trophy sale. Fifteen laboratory reports were written reporting the results of hair analysis, necropsies, food habits analysis, and animal condition tests. Twenty-four requests for reference specimens and educational material were processed. Materials for wildlife education were loaned out to teachers and wildlife educators 85 times. The biotelemetry frequency database was updated and results reported to the FCC frequency coordination committee. Animal immobilization throughout the state was coordinated. Work continued on monitoring of wildlife parasites through cooperation with the Veterinary Molecular Biology Laboratory. Special research conducted included mountain lion studies, pine marten studies, and grizzly bear studies. Wolf, mountain lion, and grizzly bear mortalities were recorded. Management recommendations are presented.


## INTRODUCTION

The Wildlife Laboratory has served research and management in Montana since 1955. The laboratory provides important services to wildlife biologists in Montana and conducts critical research on topics which must be investigated within a laboratory setting. Its history has been dynamic, developing with the ever changing needs of the wildlife scientists within the state.

Wildlife Laboratory activities serve many functions. The work at the laboratory produces valuable resources used in the Montana Department of Fish, Wildlife and Parks (MDFWP) information and education programs. It provides data and conducts research important to decision makers in wildlife management programs. The laboratory coordinates with other laboratories conducting similar work in neighboring states and within the state. In addition, work at the wildlife laboratory assists law enforcement personnel during investigations of wildlife crimes.

This report summarizes the results of laboratory investigations for the period from July 1991 through June 1992, Fiscal Year 1992. The work conducted is ongoing and will continue into next fiscal year.

## JOB OBJECTIVES

1. Provide wildlife laboratory services to management and research biologists through determination of food habits, reproductive status, sex, and age of wildlife specimens submitted from throughout the state.

2. Necropsy wildlife specimens suspected of being diseased, parasitized, or dying of unknown causes to identify the probable cause of death. This includes submitting various tissue samples to appropriate laboratories for testing if warranted.

3. Coordinate and supervise the department's wildlife immobilizing drug program and conduct research on new drugs as they become available.

4. Maintain and add to reference collections of plant and animal materials.

5. Coordinate the department's wildlife/pesticide program.

6. Coordinate and maintain a central file of radio frequencies being used to mark various species of wildlife throughout the state.

7. Obtain and prepare specimens to fill requests for study skins, tanned hides, mounted specimens, skulls, and other skeletal materials to be used by department personnel and others for educational displays and programs.

8. Assist other research and management biologists in construction of various animal markers and in capture and handling of animals.

9. Conduct special physiological investigations as requested:

    a. Test serological techniques of determining pregnancy in big game animals

    b. Test ultrasonic pregnancy detection devices for reliability and validity of detecting pregnancy in live big game animals

    c. Relate physiological parameters of wildlife specimens to range condition, climatological factors, population structure and size, and various management strategies in various population units in the state.

## METHODS

Food habits were determined using standard laboratory procedures: sampling, identification of food items using appropriate keys and known reference materials, volumetric measurement, and storage. Findings were returned to the original collectors for tabulation, interpretation, and final reporting.

Blood samples were obtained from big game animals during regular trapping and handling of animals for research or management purposes. Hematology and blood chemistry measurements were done by the Livestock Department's Veterinary Diagnostic Laboratory in Bozeman.

Female reproductive tracts were prepared for examination, ovaries for sectioning, and bacula and testes for development. Uteri were examined for scars and embryonic or fetal tissue. Blood serum samples were submitted to the University of Idaho for measurement of pregnancy specific protein B levels.

Ages of big game animals were determined by tooth replacement and wear characteristics. Ages of bears, lions, and furbearers were determined by cementum annuli counts of sectioned teeth and/or skull characteristics. Radiographs were used to determine juvenile from adult pine marten (Nagorsen et al. 1988).

Skulls of harvested grizzly bears and mountain lions and carcasses of marten from throughout Montana were required or requested to be turned in. Skulls of bobcat trapped in Regions 2 and 3 were collected. Skulls from these animals, plus those of other lions, bears, and furbearers received in the lab, were cleaned by boiling and returned to the hunter/trapper if requested.

Hides, capes, antlers, horns, black bear claws, and elk canine teeth were sold at a public auction held in April 1992.

Bear and goat teeth were pulled, sheep and goat horns were measured, sheep horns were plugged for hunters, and furbearer pelts were tagged for trappers.

Various measurements and biological samples were taken from bison taken by FWP personnel during 1991-92.

Liaison was maintained with other laboratories. Emphasis of this cooperation involved necropsy of specimens to determine cause of death and examination of wildlife for parasites and diseases. Tissues were collected to assist various research conducted in other laboratories throughout the United States. Primary labs involved are the Veterinary Diagnostic Lab and Veterinary Molecular Biology Lab, both in Bozeman. Other labs to which specimens are sent include the National Wildlife Health Research

Lab in Madison, Wisconsin; the National Veterinary Services Lab in Ames, Iowa; and The National Forensics Laboratory in Ashland, Oregon.

Statistical analysis was conducted using STATGRAPHICS software. Statistical significance indicates 95% confidence unless otherwise specified. Statistical tests used include ANOVA, Students t, or Chi-square as specified. Graphics were produced using HARVARD GRAPHICS software. Database management was conducted with DBASE III PLUS software.

## SPECIAL ELK DISEASE STUDY

Tissues and blood were collected from hunter harvested elk. Prelabeled collection kits were assembled at the MDFWP lab. The collection protocol included collecting various tissues from generalized body regions. Blood was taken from the body cavity or heart and collected in two red top and one heparinized green top blood tubes. Heads were collected at check stations. Tissues collected from each head included parotid, mandibular, retropharyngeal lymph nodes, and tonsils. From the thorax, a sample of lung, heart, and the tracheobronchial and mediastinal lymph nodes were collected. From the abdomen, various nodes including the hepatic and mesenteric lymph node and spleen, liver, kidney and ileocecal intestine were collected. Reproductive tissue collected included the ovaries, portions of the uterus, and fetus, if present. A sample of amniotic fluid was collected from all pregnant elk. Fecal samples were collected from each specimen. Samples were collected in clean plastic or whirlpak bags.

At the Wildlife Laboratory, tissues were cleaned, trimmed, and sectioned with half of each sample going into buffered formalin and the other half placed in sterile whirlpak bags and frozen. Lungs were palpated and examined for tubercular lesions. The liver was serially sectioned and examined for parasites and lesions. All lesions were noted and sectioned out of lung or liver tissue for histopathological examination and bacteriology. Fetuses were counted and sexed, then saved for later examination to determine conception dates. Blood samples were centrifuged and the serum poured into cryo-tubes. The heparinized blood was frozen and packaged for shipment to the National Veterinary Services Laboratory.

Culture work and histopathological examinations were conducted at the National Veterinary Services Laboratory. Blood serology was conducted at the State Diagnostic Laboratory in Bozeman. The MSU Veterinary Molecular Biology Laboratory/ Parasitology Section conducted the fecal flotations and Baermans of the feces.

## RESULTS AND DISCUSSION

### General Specimen Processing

Two hundred general wildlife specimens representing 19 species were submitted to the laboratory for various processing (Table 1). General specimens include those specimens other than special trapper/hunter collections.

Table 1. General specimens received and processed at the Wildlife Laboratory during Fiscal Year 1992.

| Species | No. Processed | Percentage |
|---|---|---|
| Bald Eagle | 3 | 1.5 |
| Beaver | 2 | 1.0 |
| Bighorn Sheep | 27 | 13.5 |
| Black Bear | 51 | 25.5 |
| Bobcat | 10 | 5.0 |
| Bison | 9 | 4.5 |
| Coyote | 1 | 0.5 |
| Elk | 7 | 3.5 |
| Fisher | 4 | 2.0 |
| Golden Eagle | 7 | 3.5 |
| Grizzly Bear | 6 | 3.0 |
| Mink | 2 | 1.0 |
| Moose | 6 | 3.0 |
| Mountain Lion | 42 | 21.0 |
| Mule Deer | 7 | 3.5 |
| Sandhill Crane | 1 | 0.5 |
| White-tailed Deer | 10 | 5.0 |
| Wolf | 1 | 0.5 |
| Wolverine | 4 | 2.0 |
| Total | 200 | 100.0 |

Skeletal materials processed this year included skulls from 270 mountain lion, 30 pine marten, 25 various furbearers, 40 bobcat, and 60 bear.

### Food Habits

Approximately 70 rumens from deer studies in the Colstrip area, Bridger Mountains, Lee Metcalf Wildlife Refuge, and the Flathead Valley were fixed and stored. Biologists from the Flathead and Colstrip studies have examined and recorded the

findings in their reports. The remaining rumens are stored and awaiting identification of contents.

Over 1000 grizzly bear scat samples were collected by field projects and presented for analysis during the report period. The samples were accessioned and analysis was conducted on contract by Wildlife Services Inc (Kevin Frey). Coordination for processing these samples was provided by the MDFWP Wildlife Laboratory and results were archived, then disseminated to various projects.

Nearly 300 stomach and colon samples from various species were examined and their contents determined. Approximately 66% of these were from marten submitted by trappers. Other samples examined include mountain lion, grizzly bear, and various furbearing species. These data will be analyzed further and summarized in later reports. Results of analysis of contents of marten stomachs and colons collected from the 1990-91 trapper harvest are presented in the Pine Marten Studies section of this report.

The U. S. Forest Service (USFS) submitted nine suspected wolf scats from the East Front area west of Augusta and Choteau. Because of the small number of scats and that most did not appear to be from wolves, this data will not be presented. Results of analysis were distributed to the USFS.

Nutrition

Blood samples were obtained from 557 animals including elk, white-tailed deer, mule deer, bighorn sheep, moose, black bear, and grizzly bear. Serum biochemistries were run on these samples to determine normal background values and explore the possibility of using some of the parameters as an index to animal or herd condition. Test results were returned to the projects which submitted the samples and one copy retained in our files to be entered into a master computer database maintained at the laboratory. The data available in this master file will allow comparisons of herd condition between years and herd groups.

A database was created to compile information on blood biochemistries and hematology. The database format was completed and a data entry screen completed. The process of data entry will continue through the next year. Over 3900 samples are recorded in the master file.

Animal Reproduction

Reproductive tracts were collected from various wildlife processed through the laboratory including otter, bear, lion, wolf, bobcat, fisher, and marten. Tracts are fixed and later examined to count corpora lutea and placental scars. During the report period, 15 grizzly bear and 100 juvenile pine marten tracts were examined. Results from the examination of pine marten reproductive tracts were not available for this report. A

summary of results from the examination of grizzly bear tracts was completed for inclusion in a paper presented at the International Bear Conference in Missoula in February 1992.

Serum samples from 371 elk were submitted for pregnancy determinations based on radioimmunoassay for pregnancy-specific protein B (PSPB). This technique has proven reliable in detecting pregnancy in domestic cattle and sheep as well as in free-ranging mule and white-tailed deer (Wood et al. 1986).

Fetuses were collected during tissue collections and from hunters in Hunting Districts (HD) 311 (N=53), 313 (N=186), and 362 (N=113). The sex, length, and weight was determined for each fetus. Fetal age was determined for each specimen, and conception and birth dates were calculated. The data will be pooled with additional information from previous years and other areas to present in a separate report suitable for publication.

To confirm the accuracy of PSPB assays in elk, serum samples and female reproductive tracts were solicited from hunters participating in post-season antlerless elk hunts in HDs 311, 313, and 362. Previous PSPB determinations of pregnancy among elk of known pregnancy status were highly accurate (Aune and Schladweiler 1991). However, assays run on our current sample which included 46 males and 325 females from which both a reproductive tract and an adequate blood sample were received showed an unacceptably high error rate. The reproductive physiology laboratory at the University of Idaho is currently trying to determine the source of error and what corrections can be made to overcome the problems observed.

Age Determinations

During the report period, 607 teeth were submitted to Matson's Laboratory for counts of cementum annuli. Three hundred forty-six marten teeth were x-rayed to classify juveniles from adults. Results were filed and distributed to various programs. Results of cementum annuli counts were compared to other aging techniques when possible.

Tests were conducted on aging of mountain lions using cementum annuli in the premolar tooth and aging pine martens with x-rays and cementum annuli. Results are presented in Pine Marten Studies and Mountain Lion Studies sections of this report.

Pine Marten Studies

A total of 334 pine marten carcasses were collected during 1990-1991. This is considerably less than the number (750) collected from the 1989-90 season. Most of the decline has resulted from decreasing price of pine marten pelts between these trapping seasons. Analysis of data from the carcass collections for 1990-91 was not completed.

Analysis to be completed include determining the age of 335 carcasses and examining the reproductive tracts from 43 female martens. Complete findings will be available in the next annual report.

Pine Marten Food Habits

Stomachs and colons examined for food habits totalled 90 and 101, respectively. Remaining stomachs and colons examined were empty. Because of the small sample for individual regions, the data was pooled (Table 2). Findings were similar to those for previous years, with mice being the primary prey and microtines comprising the greater portion of identified remains.

Table 2. Winter 1990-91 food habits of Montana marten as determined from examination of stomach and colon contents. Figures are percent frequency of occurrence/percent of total diet.

| FOOD ITEM | Stomachs (N = 90) | Colons (N = 101 | TOTAL (N = 191) |
|---|---|---|---|
| Cervid | 16/10.9 | 14/11.4 | 15/11.2 |
| Unid. large mammal | -/- | 1/1.0 | 1/0.5 |
| TOTAL LARGE MAMMAL | 16/10.9 | 15/12.4 | 15/11.7 |
| Pocket Gopher | 1/1.1 | 2/2.0 | 2/1.5 |
| Flying Squirrel | 2/2.2 | 1/1.0 | 2/1.6 |
| Red Squirrel | 7/6.3 | 2/2.0 | 4/4.0 |
| TOTAL "LARGE" RODENT | 10/9.6 | 5/5.0 | 7/7.1 |
| Microtus | 1/1.1 | -/- | 1/0.5 |
| Clethrionomys | 27/25.2 | 4/4.0 | 15/13.9 |
| Unid. Microtine | 10/8.8 | 10/9.8 | 10/9.3 |
| Peromyscus | 3/2.4 | -/- | 2/1.1 |
| Unid. Mouse | 26/20.0 | 51/50.1 | 39/35.9 |
| TOTAL "SMALL" RODENT | 68/58.1 | 65/63.9 | 66/61.2 |
| LAGOMORPH | 12/10.3 | 6/5.0 | 9/7.5 |
| BIRD | 10/3.4 | 6/5.0 | 8/4.2 |
| VEGETATION | 6/3.3 | 9/3.8 | 7/3.5 |
| MISCELLANEOUS | 12/4.4 | 5/5.0 | 8/4.7 |

Animal Immobilizations

Immobilizing drug needs were solicited from FWP personnel statewide. New supplies of Telazol, Ketamine Hydrochloride, and Rompun were purchased. Ketamine and Rompun were freeze dried and bottled for use in various projects throughout the state. The computer database with all drug purchases and distribution was updated during the report period. The Department DEA permit was renewed. Consulting was provided to FWP personnel during various immobilization situations throughout the state. A suggested moose handling protocol was distributed. Summaries of the statewide drugging and handling form were reviewed and filed. Additional equipment purchases were made to upgrade the laboratory tranquilizing equipment. Outdated drug stocks were incinerated. A new animal-handling manual was reviewed and edited for professional colleagues.

Bison Studies

Monitoring and data collection during bison management activities in the Gardiner and West Yellowstone areas were conducted under contract to Wildlife Services Inc. and in cooperation with the Montana Department of Livestock. Two hundred eighty bison died during the 1990-91 fiscal year; 271 bison were killed during management actions and 9 in collisions with vehicles.

Bison have been killed in Montana each year since 1984 (Fig. 1). Man-caused mortality has fluctuated widely with varying winter conditions and socio-political environments.

Blood was collected from 266 bison including 26 samples collected by Texas A & M from bison killed for scientific study. Results from the Texas A & M samples will be reported elsewhere. Of the remaining 240 bison tested serologically, 85 (35.4%) were reactors, 24 (10%) were suspect, and 131 (54.6%) were negative. This is not significantly different than findings reported by Pac and Frey (1991) from the 1988-89 period (Chi-square=126.144, 1 d.f., P=0). Our central database indicates that since 1985 a grand total of 904 bison sera have been tested, and 445 (49.2%) tested positive or suspect while 459 (50.8%) tested negative.

The proportion of males positive or suspect (49.7%) was slightly higher than for females (39.6%). There was no statistical difference in the proportions of sero-positive or suspect to sero-negative brucellosis tests between the sexes (Chi-square=22.35, 1 d.f., P=0.000002).

A bison tissue collection protocol was established in 1991-92 by the Montana Department of Livestock. When possible, lymph nodes, reproductive organs, and blood were collected to culture for *Brucella abortus*. Data from the collections were shared among various cooperators. Records in MDFWP files indicate that tissue was collected

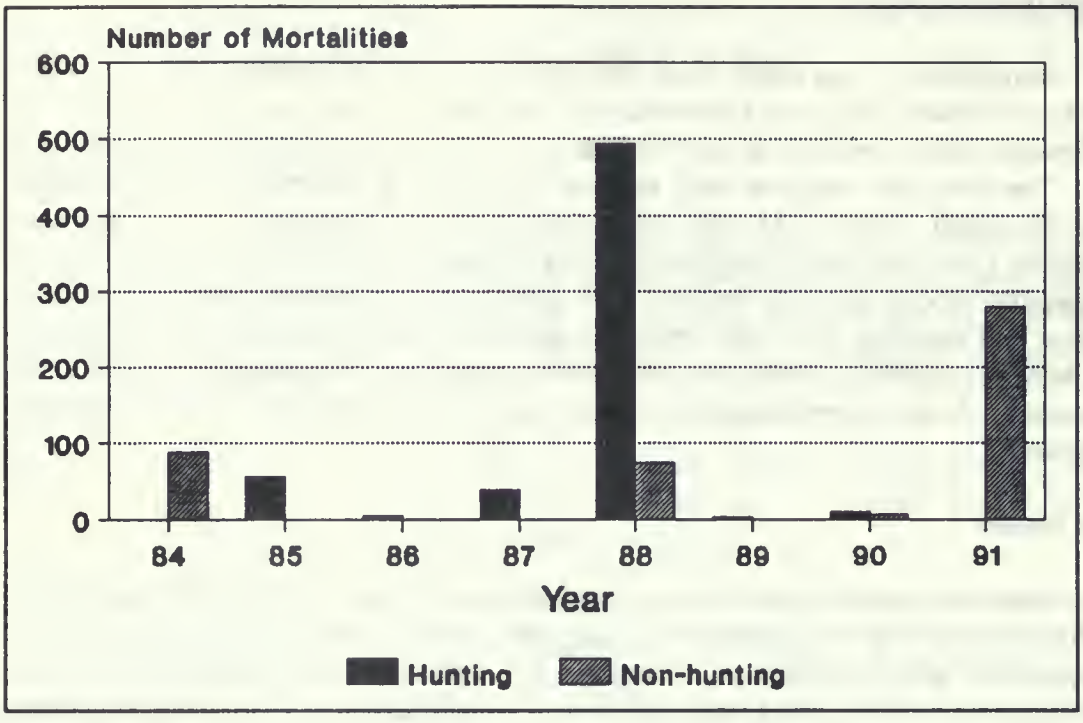


Figure 1. Annual hunting and non-hunting bison mortalities, 1984-91.

and bacteriology conducted on 218 bison not including the 26 Bison collected by Texas A & M. Twenty-six (11.9%) of the bison tested were culture positive for *Brucella abortus*. The 26 culture positive bison included 18 males (69.2%) and 8 females (30.8%). This included two male bison that were sero-negative. All other bison culture positive were serologically positive or suspect reactors.

Sixty-seven female bison of reproductive age were collected in 1991-92. This sample does not include data from 22 female bison collected by Texas A & M. Forty-nine (73%) of the adult female bison were pregnant, similar to the 74% pregnancy rate reported by Pac and Frey (1991). Two of the 67 adult female bison of reproductive age (2.9%) were culture positive.

Observations reported by Wildlife Services Inc. indicate that 97.8% of the bison leaving Yellowstone National Park (YNP) during the 1991-92 winter returned prior to the start of bison calving in mid-April. Several bull bison remained outside of YNP during the spring, and six male bison were killed on the highway near West Yellowstone.

Brucella cultures of tissues from the 1991-92 bison indicated that the infection rate of bison in Yellowstone National Park is significant. However, the risk of transmission due to infected reproductive fluids or aborted fetuses has not been determined. Given the short overlap in the timing of use of cattle ranges and the observed infection rate of adult females, the probability of bison to cattle transmission might be low. Further work

defining the ecological parameters as well as the pathological and epidemiological variables is needed to define risk. Before adequate risk analysis can proceed, considerable research is recommended. Many variables in the natural environment have yet to be defined or measured, and results of laboratory-induced infection or transmission may not be directly relevant to the natural environment surrounding Yellowstone National Park.

Animal Necropsies and Tissue Examinations

A total of 77 specimens representing 14 species of birds and mammals were examined to determine the cause of death or to identify tissues, parasites, or abnormalities (Table 3). Fifty-nine necropsies were conducted, and nine tissue samples were examined by the Veterinary Pathologists at the State Diagnostic Laboratory. Nine necropsies were performed at the MDFWP Laboratory. Necropsy reports were filed and distributed to requestors. Three hair analysis reports were done, and bone marrow compression tests were conducted on mule deer from the Bridger Mountains.

Table 3. Species and frequencies of wildlife specimens submitted to the State Diagnostic Laboratory for necropsy and tissue examinations during FY 92.

| Necropsy Type/Species | Frequency | Percentage |
|---|---|---|
| Edible meat/Tissue exams | 9 | 13.2 |
| Antelope | 2 | 2.9 |
| White-tailed deer | 6 | 8.8 |
| Mule deer | 3 | 4.4 |
| Moose | 1 | 1.5 |
| Mink | 1 | 1.5 |
| Bighorn sheep | 21 | 30.9 |
| Mountain lion | 3 | 4.4 |
| Wolf | 1 | 1.5 |
| Coyote | 2 | 2.9 |
| Bobcat | 1 | 1.5 |
| Beaver | 2 | 2.9 |
| Eagle | 3 | 4.4 |
| Mallard duck | 12 | 17.6 |
| Magpie | 1 | 1.5 |
| Total | 68 | 100.0 |

Annual Trophy Sale

The annual trophy sale was conducted in April. There were 162 items sold including hides, capes, skulls, claws, and antlers from nine species of mammals. Parts

from bighorn sheep, black bear, and mountain lion were the most common sale items. Gross sale proceeds were $23,148.50 A total of 88 bidders from throughout the U.S. and Canada registered at the sale.

Educational and Display Materials

The wildlife mounts and reference specimens for local wildlife educational programs were available at the Wildlife Laboratory throughout the year. Specimens were checked out by educators 85 times during the report period. Several specimens were loaned to other agencies and institutions engaged in wildlife education programs.

Several educational and display materials were prepared during the year. These include a mounted lion with lion cubs, a mounted swift and kit fox display, two mounted snowy owls, two mounted saw-whet owls, a tanned black bear hide, a tanned wolverine hide, one bear board, and several tanned lion hides. Several green hides were distributed to MDFWP wardens for use in the decoy program. A bighorn sheep head and cape was prepared to present as a gift to Montana's sister province in Japan. Several hides were loaned to the Museum of the Rockies for the Rediscovering Yellowstone display.

Thirty-four requests for specimens from our hide and skeletal reference collections were received during the year. Twenty-four requests were filled or partially filled. Eight tanned or green hides were distributed to various institutions, agencies, and museums throughout the U. S. In addition, over 31 skulls from various mammals were distributed to requestors. Requests for jawboards, skeletons, bear claws, antlers, bird study skins, and elk teeth were also filled. One bison robe and three grizzly hides were donated to representatives of several Native American organizations.

Biotelemetry Frequency Coordination

In 1989, all known users of wildlife biotelemetry in the State of Montana provided information on wildlife transmitters they operated in various programs. The data from this census was entered into a computer database in 1990. A survey was conducted in November 1991 to update the computer database. Updates to the data were made throughout the year as information was received from projects. A new, thorough update is in progress.

Frequencies ranged from 148.000 to 171.000 for wildlife telemetry devices. The most commonly used range was 150.000 to 152.000 (Table 4). Approximately 1,217 of the listed telemetry devices were operating on wildlife through the report period. The remainder were on order, in storage, or being rebuilt. Telemetry devices operated on 20 species of wildlife (Table 5). Elk, mule deer, white-tailed deer, moose, and grizzly bear were the most common species radio collared.

Table 4. Distribution of radio frequencies used on wildlife telemetry devices, 1991-92.

| Frequency Range | No. Transmitters | Percentage |
|---|---|---|
| 148.000-149.000 | 132 | 5.3 |
| 150.000-151.000 | 776 | 30.9 |
| 151.000-152.000 | 971 | 38.6 |
| 152.000-153.000 | 138 | 5.5 |
| 153.000-154.000 | 10 | 0.4 |
| 164.000-165.000 | 249 | 9.9 |
| 165.000-166.000 | 219 | |
| 166.000-167.000 | 9 | 0.3 |
| 167.000-168.000 | 9 | 0.3 |
| 171.000-172.000 | 1 | 0.1 |
| Total | 2,514 | 100.0 |

Table 5. Biotelemetry devices ordered, stored or operating on wildlife species in and near Montana, 1991-92.

| Species | No. Devices | Percentage |
|---|---|---|
| Elk | 943 | 39.0 |
| Deer (WT and MD) | 492 | 19.6 |
| Moose | 75 | 3.0 |
| Grizzly bear | 311 | 12.4 |
| Black bear | 49 | 1.9 |
| River otter | 6 | 0.2 |
| Bald eagle | 28 | 1.1 |
| Mountain goat | 8 | 0.3 |
| Bighorn sheep | 21 | 0.8 |
| Wolf | 42 | 1.7 |
| Golden eagle | 1 | 0.1 |
| Caribou | 27 | 1.1 |
| Fisher | 51 | 2.0 |
| Sharptailed grouse | 45 | 1.8 |
| Turkeys | 80 | 3.2 |
| Boreal owl | 2 | 0.1 |
| Sage grouse | 7 | 0.3 |
| Hawk | 12 | 0.5 |
| Pine marten | 24 | 0.9 |
| Mountain lion | 73 | 2.9 |
| Unknown or other | 217 | 8.6 |
| Total | 2,514 | 100.0 |

Fourteen agencies or institutions have participated in the radio telemetry coordination program in 1991-92 (Table 6). The Montana Dept. of Fish, Wildlife and Parks was the agency most commonly employing biotelemetry in their programs.

Table 6. The number of biotelemetry devices used in various wildlife programs throughout and near the State of Montana, 1991-92.

| Wildlife Agency | No. of Devices | Percentage |
|---|---|---|
| The Blackfoot Nation | 18 | 0.7 |
| Confederated Salish Kootenai | 14 | 0.6 |
| U. S. Forest Service * | 19 | 0.8 |
| Mont. Dept. FWP | 1,651 | 65.7 |
| U.S. Fish and Wildlife Serv. | 148 | 5.9 |
| Glacier Natl. Park | 23 | 0.9 |
| Idaho Fish and Game | 44 | 1.8 |
| Interagency Grizzly Study | 135 | 5.4 |
| Montana State University | 143 | 5.7 |
| University of Montana | 204 | 8.1 |
| Wildlife Wildlands Inst. | 3 | 0.1 |
| Wildlife Research Inst. | 71 | 2.8 |
| Yellowstone Natl. Park | 8 | 0.3 |
| Other or Unknown | 31 | 1.2 |
| Total | 2,512 | 100.0 |

* Includes radio frequency for hand radios.

## Parasites of Wildlife

Trichinella tests were completed on black bears, mountain lions, and bobcat, most of which were submitted by hunters. Records of trichinella testing of these animals were not completely available at the time of this report. Under a formal agreement with Veterinary Molecular Biology, a program to test black bear harvested by hunters was initiated. During the period, 58 black bears were tested, and three (5.2%) were positive for trichinella. A collection packet was developed and distributed to each region to facilitate the testing of black bears for this parasite. An informational pamphlet was developed and is ready for print. Distribution will be statewide through MDFWP regional offices and most County Extension Service Offices.

Complete evaluations of parasites were conducted on several specimens in the report period. Gastro-intestinal (GI) tracts from three grizzly bears and one wolf were submitted for parasitology evaluations. Results are pending. The GI tracts from 12 mountain lions were frozen and stored for future evaluations.

One mule deer in poor condition from the Bridger Mountains was submitted to a parasitology examination. *Cephenymia* spp. were found in the nasal sinus. In the mesentery, *Taenia* spp. cysts were noted. Fecal flotation was positive for *Nematodirus* spp. and *Moniezia* spp. Ectoparasites observed included *Dermacentor* spp. and keds. A white-tailed deer in Region 3 tested positive for *Eimeria* spp. in fecal flotation. Three mature specimens of the giant liver fluke (*Fascioloides magna*) were found in the liver of one white-tailed deer from Montana. This parasite has been rarely identified in wildlife from the Montana region (Worley personal communication).

A case of chronic dermatitis caused by unidentified mites was diagnosed in a mule deer from Meagher County. Several cases of fungal dermatitis were diagnosed in antelope from Region 5. A severe case of mange was diagnosed in a coyote from Region 7.

White-tailed deer heads collected statewide were examined to determine the presence of the meningeal worm *Paraelaphostrongylis tenuis*. Deer heads examined totalled 113 with most coming from western Montana (78 from Region 1 and 32 from Region 2). All heads examined were negative for brainworm. Collections and evaluations are continuing with emphasis in eastern Montana.

Due to a sheep die-off in the Anaconda area, four GI tracts were submitted to parasitology for evaluations. Examinations revealed the presence of *Marshallagia* spp., *Nematodirus* spp., and unidentified trichostrongyles. Examinations were negative for lungworm. At least one of these sheep had a significant parasite load. Some ectoparasites (*Dermacentor* spp.) were noted also. Results of the bacteriology and histopathology are reported below. A bighorn sheep near Melrose in Region 3 tested positive for *Nematodirus* spp.

Diseases of Wildlife

Blood serum samples from several species of wildlife were tested by the Diagnostic Laboratory for the presence of antigen/antibodies against anaplasmosis, bluetongue, brucellosis, and leptospirosis. Additional diseases tested for in some samples included infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD), and parainfluenza 3 ($PI_3$). Results from these additional tests will provide baseline data for comparison with data collected in subsequent years.

A computer database was completed with entries from serological surveys conducted throughout the state. The database includes over 6500 records from many species including deer, sheep, elk, moose, bear, and lion. The file editing and clean-up is complete. Detailed analysis is proceeding. This data will be updated annually allowing further analysis of serological survey results.

Regional analysis of serologic survey data indicate that the proportion of sero-positive or suspect reactors for brucellosis is less than 1% in all species tested (Table 7). The highest percentage of reactors occurs in elk and bighorn sheep. The only regions in Montana recording a positive or suspect result for brucellosis are Regions 1, 2, and 3. Outside of the Region 3 area surrounding Yellowstone National Park, serological evidence of brucellosis is very rare. Testing for brucellosis has been rare or non-existent in Regions 5, 6, and 7. Improved survey sampling is also needed in Region 4. Recently discovered data from elk and deer in Region 6 is being incorporated into the database for future evaluations. Several predators and scavengers have been tested for brucellosis. One grizzly bear from the northwest corner of Yellowstone National Park had a positive titer for *Brucella abortus*. The sample was retested to confirm the evidence. Further testing of these species will be needed to properly interpret these findings.

Table 7. Serological survey test results for *Brucella abortus*. Results are presented as the number of sero-negative over sero-positive samples.

| Region | 1 | 2 | 3 | 4 | 5 | 6 | Total | % Pos |
|---|---|---|---|---|---|---|---|---|
| Elk | 47/0 | 375/1 | 2564/21 | 223/0 | 47/0 | 12/0 | 3268/22 | 0.67 |
| Mule Deer | 20/0 | 91/0 | 352/0 | 108/0 | - | 4/0 | 575/0 | 0.00 |
| White-Tailed Deer | 622/1 | 85/0 | - | 1/0 | - | - | 708/1 | 0.14 |
| Bighorn Sheep | 17/0 | 103/2 | 38/0 | 64/0 | 3/0 | - | 225/2 | 0.88 |

Somewhat limited testing for serological evidence of hemorrhagic disease was examined for Montana (Table 8). The results presented are not specific for the blue tongue or ehd virus, so they are addressed collectively at this time. Positive titers for hemorrhagic disease are prevalent in mule deer from central Montana. Limited data is available for eastern Montana where the disease is also reported to occur. Evidence presented here suggests that positive titers in elk (0.46%) and white-tailed deer from western Montana (0.14%) are relatively rare. Positive titers have not been found in bighorn sheep tested. It is recognized that the serological evidence for this sometimes fatal disease must be interpreted cautiously.

A hemorrhagic disease survey was coordinated by the wildlife laboratory in 1991 also. This survey is part of a nationwide effort conducted by the Southeastern Cooperative Wildlife Disease Study. During fall 1991, reports were received from 16 counties. A minimum of 300-350 white-tailed deer, one mule deer, and one antelope mortalities resulting from hemorrhagic disease were reported. Although reports were widespread through the central and eastern portions of the state, the impacts were of short duration and limited severity.

Table 8. Serological survey test results for hemorrhagic disease. Results are presented as the number of sero-negative over sero-positive samples.

| Region | 1 | 2 | 3 | 4 | 5 | 6 | Total | % Pos |
|---|---|---|---|---|---|---|---|---|
| Elk | 47/0 | 171/3 | 1446/5 | 217/1 | 45/0 | 2/0 | 1928/9 | 0.46 |
| Mule Deer | 20/0 | 91/0 | 340/12 | 45/33 | 0/1 | -- | 496/46 | 8.49 |
| White-Tailed Deer | 622/1 | 85/0 | -- | 1/0 | -- | -- | 708/1 | 0.14 |
| Bighorn Sheep | 17/0 | 105/0 | 38/0 | 64/0 | 3/0 | -- | 227/0 | 0.00 |

Blood serum was tested for anaplasmosis in western and central Montana (Table 9). Elk, mule deer, and bighorn sheep showed positive titers for anaplasmosis. Bighorn sheep titers were frequently (10.86%) positive for this disease. Serologic evidence for exposure to anaplasmosis was most common in the central regions of Montana. Serum samples from eastern Montana were not available, and sampling is recommended for adequate comparison.

Table 9. Serological survey test results for anaplasmosis. Results are presented as the number of sero-negative over sero-positive samples.

| Region | 1 | 2 | 3 | 4 | 5 | 6 | Total | % Pos |
|---|---|---|---|---|---|---|---|---|
| Elk | 47/0 | 84/1 | 1395/52 | 152/60 | -- | -- | 1678/113 | 6.31 |
| Mule Deer | 20/0 | 90/1 | 331/2 | 63/5 | -- | -- | 504/8 | 1.56 |
| White-Tailed Deer | 623/0 | 84/0 | -- | 1/0 | -- | -- | 708/0 | 0.00 |
| Bighorn Sheep | 14/3 | 89/16 | 33/5 | 58/0 | 3/0 | -- | 197/24 | 10.86 |

In recent years, concern for respiratory viruses has increased. Recently collected blood serum from wildlife has been tested for infectious bovine rhinotracheitis (IBR), bovine viral diarrhea (BVD), and para-influenza 3 ($PI_3$) (Table 10). The sample sizes to date are small and could not be stratified by region, so data are pooled statewide. There is ample evidence suggesting a high exposure rate to these viruses among wildlife throughout the state. Positive titers for IBR are common in elk and white-tailed deer. BVD and $PI_3$ exposure has been very common in elk, mule deer, and sheep while slightly less prevalent in white-tailed deer tested. Little is known about respiratory disease in wildlife, but in at least some cases they may be significant factors in pneumonia in bighorn sheep. Retesting serum from the bank at the MDFWP could help identify the attack rate and possible geographic prevalence of these viruses on select wildlife.

Table 10. Serological survey test results for respiratory viruses. Results are presented as the number of sero-negative over sero-positive samples.

| | IBR | BVD | $PI_3$ |
|---|---|---|---|
| Elk | 50/299 | 86/780 | 388/384 |
| Mule Deer | 34/9 | 14/39 | 21/44 |
| White-Tailed Deer | 11/27 | 72/66 | 99/35 |
| Bighorn Sheep | 135/2 | 1/137 | 29/118 |

Blood sera were tested for each of eight sero-vars of leptospirosis (Table 11). The percentage of positive titers for leptospirosis were highest in elk and bighorn sheep. Positive titers for leptospirosis were relatively uncommon in mule and white-tailed deer. This first stage analysis did not stratify the tests by regions. There was some variation in the prevalence rate between sero-var and wildlife species tested.

Table 11. Serological survey test results for eight sero-vars of leptospirosis. Results are presented as the number of sero-negative over sero-positive samples.

| | Pomona | Har | Aut | Grp | Ict | Can | Tar | Brat |
|---|---|---|---|---|---|---|---|---|
| Elk | 2192/5 | 2188/9 | 2057/140 | 2054/143 | 2129/68 | 2124/73 | 2139/58 | 1008/90 |
| Mule Deer | 557/0 | 554/3 | 555/2 | 550/7 | 551/2 | 553/0 | 552/1 | 369/3 |
| White-Tailed Deer | 704/6 | 710/0 | 691/19 | 686/24 | 701/9 | 709/1 | 705/5 | 661/16 |
| Sheep | 216/11 | 226/1 | 195/32 | 225/2 | 211/16 | 227/0 | 223/4 | 133/7 |

Recent diagnosis of tuberculosis (*Mycobacterium bovis*) in captive elk near Corwin Springs, Montana, sparked concern for escapement of this disease in wild elk wintering nearby or migrating through the area. In 1990, 22 elk plucks were collected and examined to determine if any wild elk had acquired tuberculosis (Aune and Schladwieler 1991). Prior to the late hunting season in 1991, a tissue collection protocol was established to increase the sampling of wild elk for evidence of tuberculosis. In addition, the protocol allowed collection of data for other diseases and parasites prevalent in the elk herds tested.

In the winter of 1991-92, three separate elk herd groups were tested for various diseases with an emphasis on brucellosis and tuberculosis. The three sample groups included a group that did not associate with Yellowstone National Park and wintered on the Flying D Ranch (HD311), a segment of the Madison Valley elk herd (HD362) comprised of approximately 50% local elk and 50% elk migrating from Yellowstone National Park, and a sample group that migrated from the northern edge of YNP

(HD313) into Montana. Samples were collected and tested according to methods described previously in the Methods section. Some preliminary results are presented below.

A total of 189 tissue and blood samples were collected during the surveillance protocol. These included 141 elk from HD313, 30 elk from HD311, and 18 elk from HD362. In addition to these detailed collections, a tube of blood was collected by 58 hunters in HD311, 166 in HD362, and 578 in HD313.

None of the elk tissues cultured for brucellosis were positive in Gardiner or Flying D elk groups. One of 18 elk was culture positive for *Brucella abortus* Biovar 1 in the Madison area. There was no gross evidence of tuberculin lesions or histological evidence of tuberculosis in the samples examined. There were no positive cultures for *Mycobacterium paratuberculosis*.

None of the serum samples from HD311 had positive titers for brucellosis. Three of 184 (1.6%) serum samples from HD362 were positive for brucellosis. Tissue samples were available from two of these three elk, and *Brucella abortus* Biovar 1 was isolated from one of these elk. Eight of 719 (1.1%) samples from HD313 were sero-positive. Tissue samples were available for three of these elk but were culture negative for *Brucella abortus*.

Work is progressing on completing the examination of these tissues, and a second year's collection will be attempted. Sampling emphasis will be in the Gallatin and Madison areas that were undersampled during winter 1991. Final analysis of results will be presented in a paper submitted to an appropriate professional journal.

A significant sheep die-off occurred in early fall 1991 near Anaconda, Montana. Early samples were diagnosed as pneumonia and *Pasteurella multocida* was isolated from lung tissue. A collection protocol was established to obtain appropriate tissues for a complete diagnosis. During the catastrophe, 19 samples of lung tissue were collected and examined histopathologically, and submitted to bacteriology and virology. Each specimen was examined for lungworm, and whole carcasses collected were given a complete parasitology exam. Lungworm was not detected in the samples. Bacteriology reported eight samples were positive for *Pasteurella* spp., sometimes in conjunction with *Corynebacyterium* spp.; three were positive for *Corynebacterium* spp., sometimes in conjunction with *Streptococcus* spp.; and two were positive for *Streptococcus* spp. In addition, viral isolations of BVD and $PI_3$ were obtained from 16 of the 19 samples. The bronchial pneumonia present in this herd reduced the herd from approximately 400 animals to less than 150. Further testing of serum from 62 sheep captured during transplant operations in 1990, before the die-off in 1991, was conducted to assist in diagnosis of the cause of disease in this herd. These samples were negative for ovine progressive pneumonia and *Brucella ovis* antibodies. Our conclusion is that the pneumonia in the Anaconda sheep herd appeared to be a result of combined viral and

bacterial vectors without the associated lungworm evident in similar catastrophic events in Montana. The significant stress related factor appears to be reduced range condition in this region (Dan Hook pers. comm).

Several other important surveillance activities and disease diagnoses occurred during the report period. One case of tularemia was detected in a beaver. The organism *Francisella tularensis* was cultured from the carcass. A severe case of keratoconjuctivitis was diagnosed in an antelope from Region 5 near Big Timber. Bacteriology isolated *Moraxella* spp. One mink, one coyote, and one bobcat were submitted for rabies testing, and each tested negative.

Grizzly and Black Bear Studies

Morphology Study

Two databases were created to examine the morphology of grizzly and black bears in Montana. The mortality database includes all deaths and results from examination of bear carcasses. This database is complete with records from over 570 black bears and 752 grizzly bears. The black bear capture database includes data from over 900 black bears handled during research throughout Montana. The grizzly bear capture database includes records of 295 grizzly bears handled in the northwestern portion of Montana.

Measurements of grizzly bear skeletons collected over 30 years is complete. The information is going through format conversions and will be analyzed in the near future as time permits. Collection and measurement of skulls will also be continued as time allows. Results will be presented in the next annual report.

Nuisance Bear and Relocation Study

In the Northern Continental Divide (NCDE) and Yellowstone Ecosystems, records of relocations were compiled from capture forms provided by field personnel. In addition, summary data collected by the endangered species biologist for the Grizzly Bear Programmatic EIS was reviewed for development of a complete record of problem bear activities in Montana. Data are presented here for the calendar year rather than MDFWP fiscal year because of the annual cycle of bear activity. A database was created to record all problem incidents in Montana at the laboratory. This will be updated annually in cooperation with the state endangered species biologist. Records from 1991 are completed, and results will be reported in the next annual report or the EIS update.

To accurately measure annual variation in these activities, several definitions were developed. A relocation included movements within a bear home range as well as far outside. However, movements within home ranges (short distance) are indicated in the record. A problem case was the situation leading to control actions. Relocations includes each individual relocation (e.g. if mother and cubs are split up, the relocations

are independent). A problem incident is a reported situation which demands attention or is a significant interaction between bear and humans or their property or livestock.

In the NCDE during 1992, nine bears were relocated as a result of eight problem incidents. One incident involved two bears (bears 18/17 and 70/71). One bear was relocated as a preventative action. One bear was eventually removed from the ecosystem and sent to a zoo. One bear returned and was eventually destroyed. One relocation effort occurred in June, two in July, one in August, one in September, and three in October.

Comparisons of the last five years shows the significant amount of variation in these activities from year to year (Table 12). These variations are probably a result of short-term environmental changes which can be natural or human caused (e.g. drought, food failures, corn spills, etc.). A significant amount of relocation activity occurs both east and west of the Continental Divide. Most of the relocation activity is oriented toward females by management direction, therefore the ratio of females/males over time will be skewed. Males involved in problems are more readily removed from the ecosystem. A complete analysis of the success of relocation efforts in the NCDE was presented at the IBA conference (Riley et al. in press).

Table 12. Updated summary of grizzly bear relocations in the Northern Continental Divide during 1988-1992.

| Year | No. Bears | No. Cases/ Relocs. | Sex Ratio | No. Killed That Year | No. on East/West |
|---|---|---|---|---|---|
| 1988 | 3 | 3/3 | 1M/2F | 1 | 3E/0W |
| 1989 | 15 | 10/12 | 6M/9F | 2 | 6E/4W |
| 1990 | 9 | 9/9 | 3M/6F | 1 | 3E/6W |
| 1991 | 12 | 13/14 | 8M/4F | 2 | 8E/5W |
| 1992 | 9 | 8/9 | 3M/6F | 2 | 1E/7W |
| Total | 48 | 43/47 | 21M/27F | 8 | 21E/22W |

Records from the Animal Plant and Health Inspection Service, Animal Damage Control Division (APHIS/ADC) are filed at the laboratory annually. A statewide summary of APHIS/ADC grizzly bear control activities from 1967-1992 was conducted to determine trends in these activities (Fig. 2). The number of control actions varied from year to year. However, trend lines indicate that the actions have been stable to slightly increasing for this time period. Control kills have been reduced in recent years because many bears were relocated rather than destroyed. A notable decline in control

actions is evident for the early 1970s until 1975. The number of livestock conflicts with grizzly bears has risen since the early 1970s.

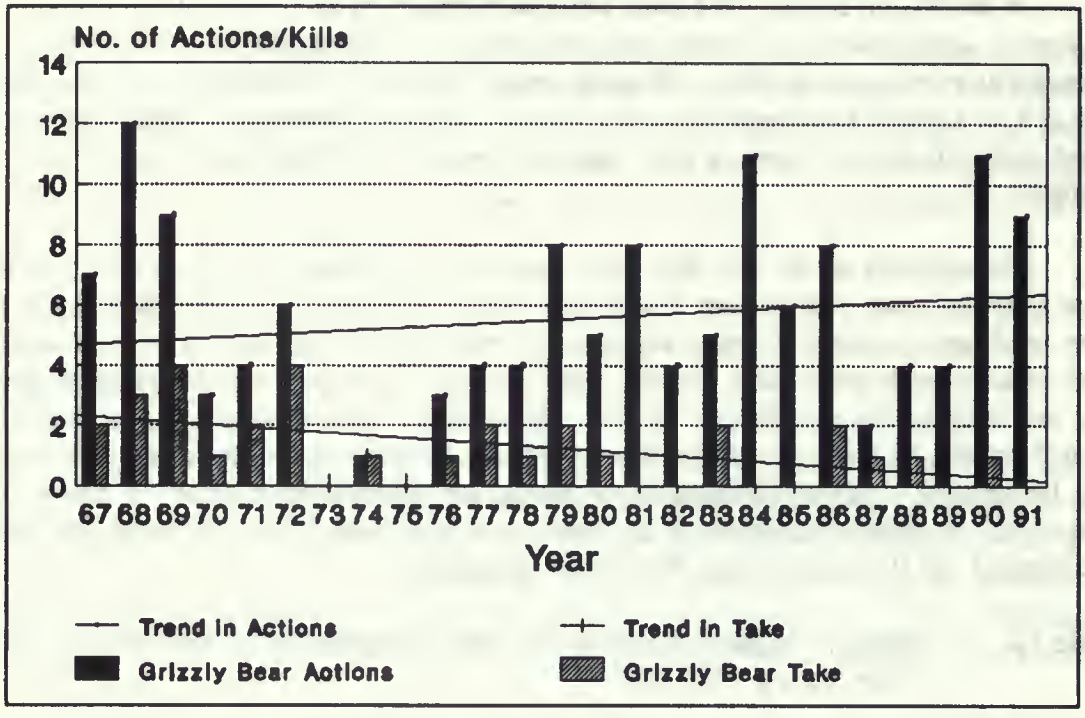


Figure 2. APHIS/ADC grizzly bear depredation actions in Montana, 1967-91.

Grizzly Mortality Studies

A master database was completed for all known grizzly bear mortalities for the Northern Continental Divide Ecosystem. Updating is in process for grizzly mortalities in the Yellowstone Ecosystem. Data in the files are being verified at this time for more complete summarization at a later date. Results presented below may be modified slightly to correct errors identified in the validation process.

For the period 1967-1992, a total of 485 grizzly bear deaths were recorded in the NCDE. The data were summarized by region in a test of the information base. In MDFWP Regions 1, 2, and 4, a total of 361, 27, and 97 mortalities, respectively, have occurred. Mortality has varied annually but has been generally declining (Fig. 3). Most deaths occurred in the months of September and October when annual grizzly bear hunting seasons were held (Fig. 4). The sex ratio of the pooled mortalities is 45.6% female and 54.4% male (Fig. 5). There were more males than females killed in all regions. Region 4 had the largest proportion of males killed.

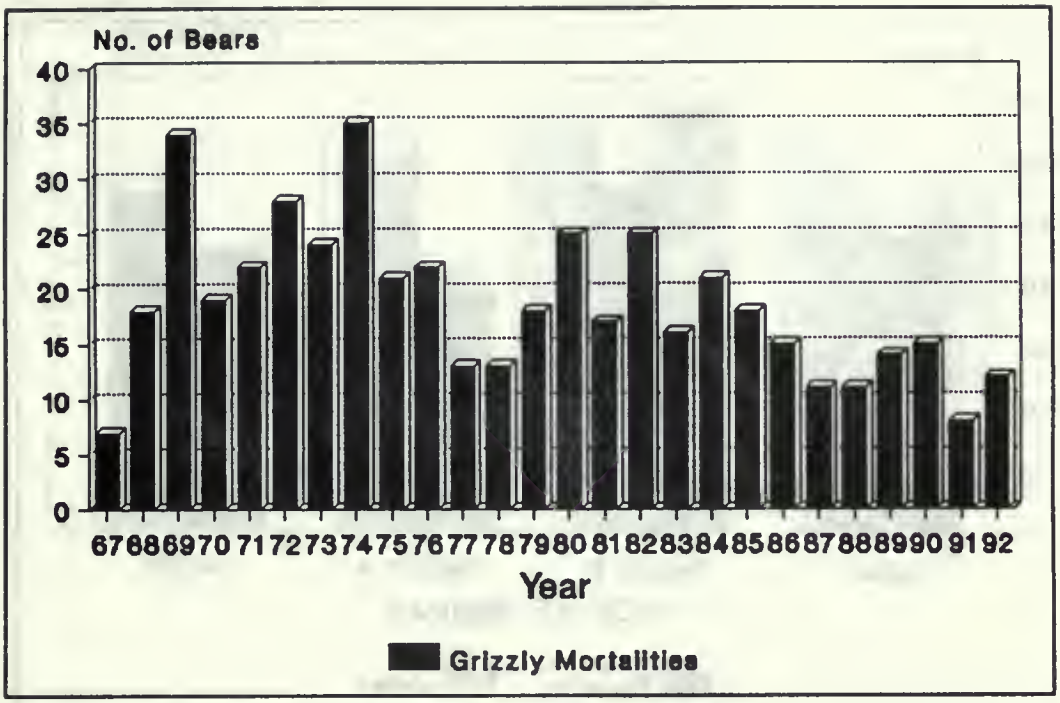


Figure 3. Annual mortalities of grizzly bears in the NCDE, 1967-92.

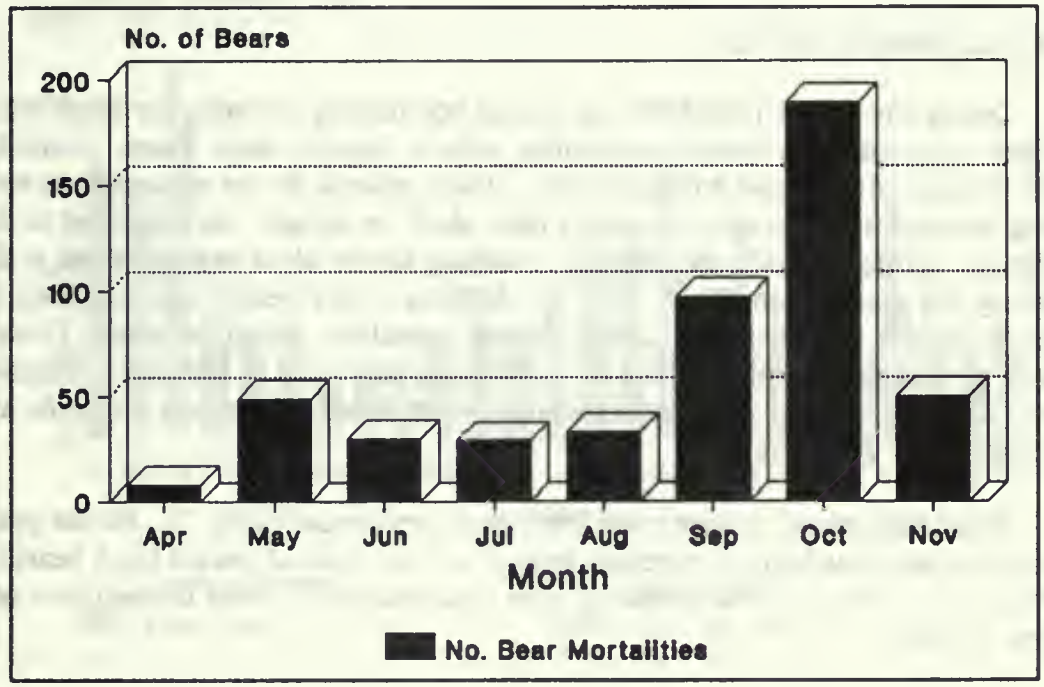


Figure 4. Grizzly mortalities by month for the NCDE, 1967-1992.

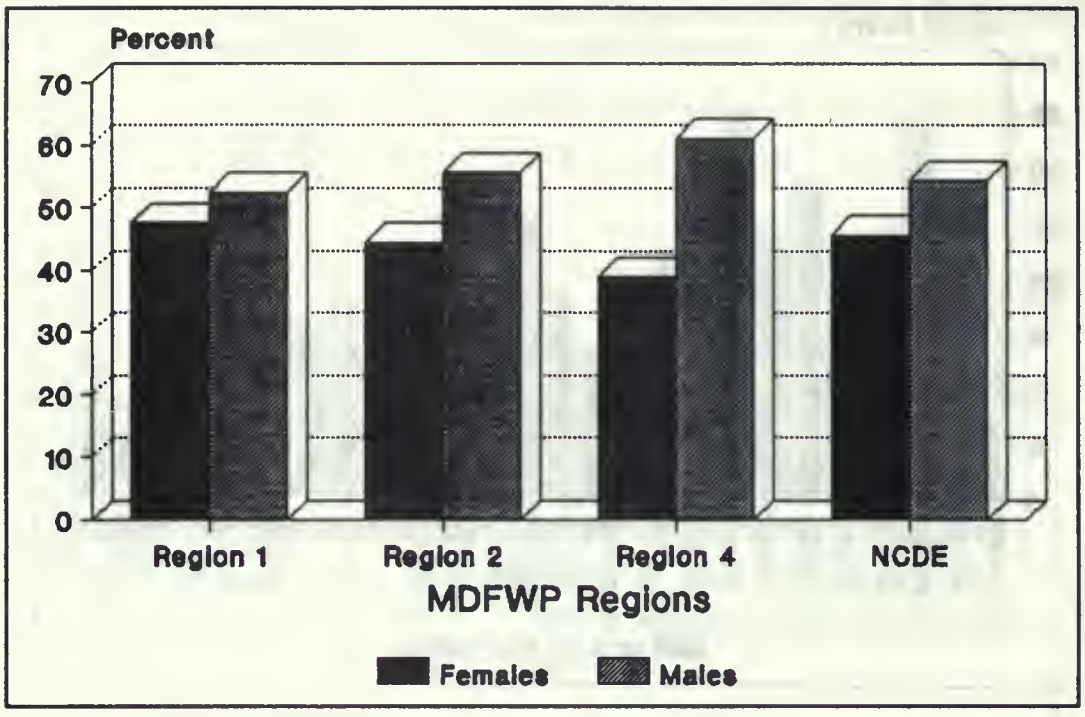


Figure 5. Sex ratio of grizzly mortalities by region in the NCDE, 1967-92.

Black Bear Mortality Studies

During the period 1986-1992, the annual non-hunting mortality for black bears has been recorded. Non-hunting mortalities include illegally taken bears, roadkills, animal damage control, and nuisance bears. These records do not represent all non-hunting mortalities, but those for which a hide, skull, or carcass was submitted to the laboratory. During 1986-92, the annual non-hunting loss of black bears reported at the laboratory has ranged from 20-38 (Fig. 6). In more recent years, there has been an increased attempt to account for the non-hunting mortalities within the state. Further work is progressing on the detailing of non-hunting mortality in Montana. Detailed report forms and accurate regional accounting of black bear mortalities statewide are recommended in the future.

Black bear animal damage control activities vary annually (Fig. 7). Recent years indicate that there has been an increased level of activity directed toward black bears by APHIS/ADC. Most of these problems have been related to sheep depredations and beehive damage.

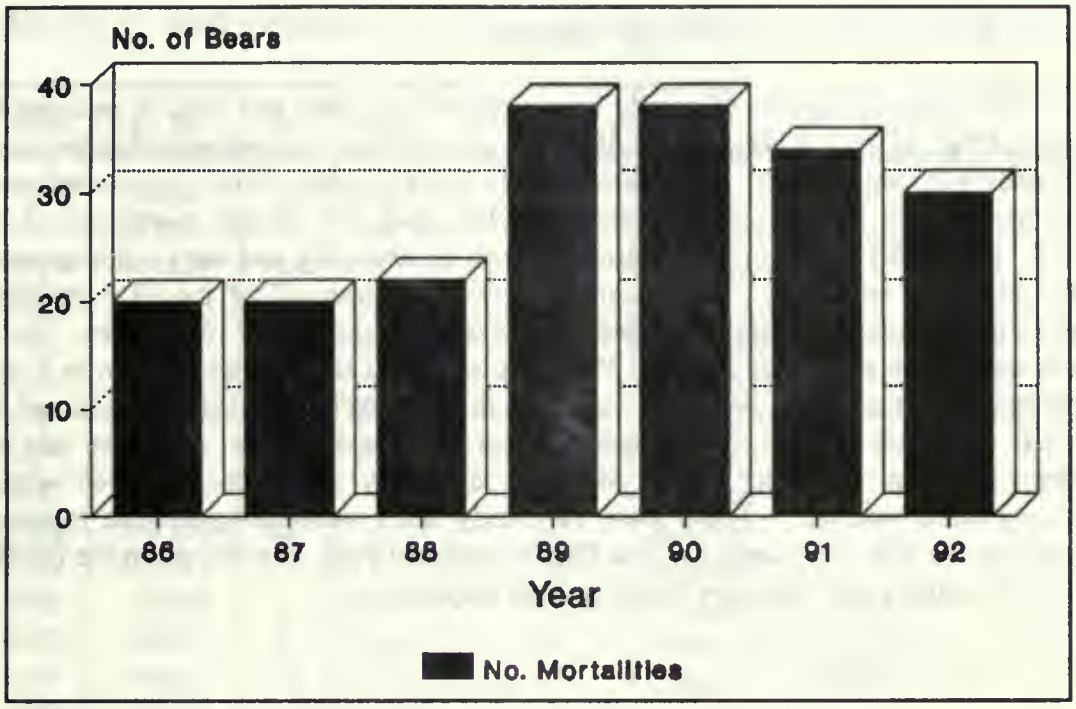


Figure 6. Non-hunting black bear mortalities in Montana, 1986-92.

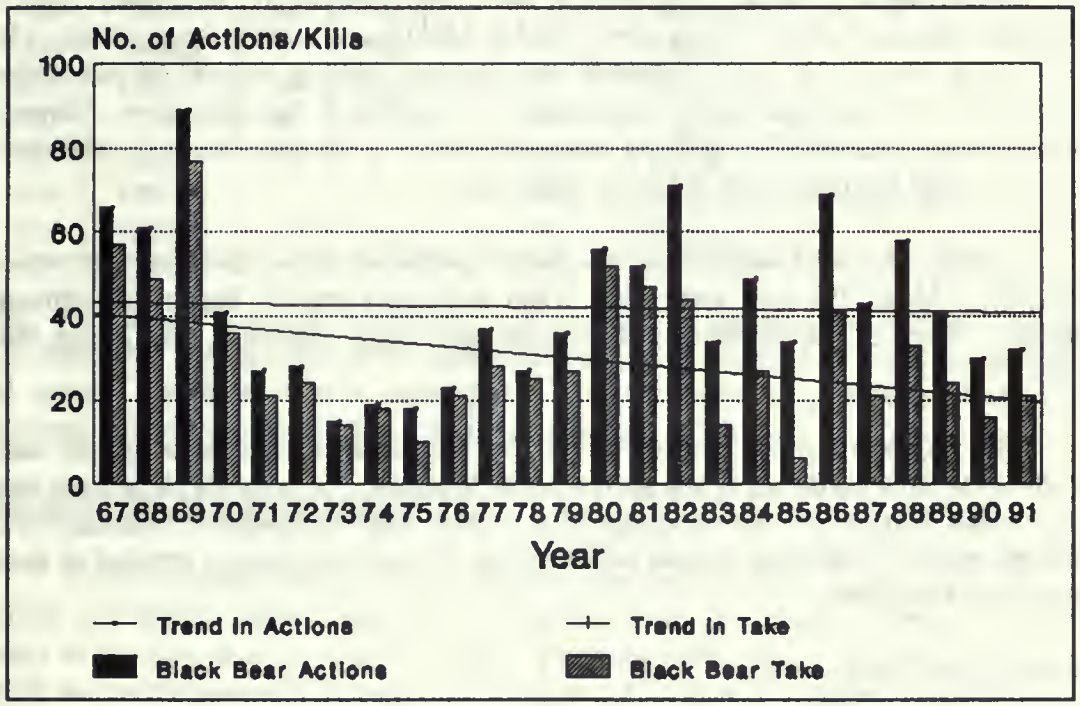


Figure 7. APHIS/ADC black bear depredation actions in Montana, 1967-91.

Disposition of 1991 and 1992 Grizzly Carcasses

The annual summary of grizzly bear mortalities in 1991 and 1992 is reported in Dood and Pac (in press 1992). Totals of 8 and 22 mortalities were reported for the years 1991 and 1992, respectively. These included four live removals. Parts were not retained or collected from four hunter mortalities (NCDE) and four natural mortalities (3 in NCDE, 1 in YNP). Three grizzly carcasses went to Wyoming and were not examined in the MDFWP laboratory. Specimens were obtained from 17 of the 19 mortalities where a carcass may have been available. Skulls were obtained from 16 grizzlies. Three skulls were given to Glacier National Park, one skull and skeleton were given to MSU Anthropology Department, one skull was given to the IGBST, one skull was returned to the BIR, one skull was put in the Region 3 Bear Box for education, two were held as evidence and the remainder are in MDFWP laboratory collections. Eleven whole carcasses were received. Hides from 10 grizzly bears were salvaged. One is being returned to the BIR, three were given to Glacier National Park, one was given the USFS, and the remaining five hides are awaiting final disposition.

Wolf Mortality Studies

A formal wolf mortality recording process does not exist in Montana at this time. A short summary of wolf mortalities as received by our laboratory was developed to begin formalizing a process. Old records were examined in the laboratory files to determine when and where wolves were killed in Montana in recent history (Table 13). At this time, the list is fairly complete but may be missing records of mortalities recorded by other agencies but not processed or reported to the laboratory. Several specimens were processed through the laboratory before a lab protocol was established. The record may be incomplete for these specimens.

Twenty-four wolf mortalities have been reported in Montana during the period 1956-1992. Most (19) died since 1987 when wolf pack activity began in northwest Montana. Much of the mortality has included wolf pups, yearlings, and 2-year olds (48%).

The earliest mortality records came from northeastern Montana while the later records come from northcentral and northwestern Montana. All records come from near the Canadian Border with the exception of a roadkill near Yellowstone National Park. Necropsy results of the latter animal indicated that it may have recently escaped or been released from captivity.

Mountain Lion Studies

Montana mountain lions were studied by examination of previous laboratory records, 70 whole carcasses, and over 250 skulls from hunter-killed lions. A standard laboratory protocol was established for each lion skull and carcass examined. From each

Table 13. Wolf mortalities recorded through the MDFWP laboratory, 1956-90.

| Year | Lab No. | Sex | Age | Weight (lbs.) | Cause of Death |
|---|---|---|---|---|---|
| 1956 | None | M | Ad. | 86 | Mistaken ID |
| 1974 | 177049 | F | 5 | -- | Natural (skull found) |
| 1977 | 177442 | F | - | -- | Unknown |
| 1978 | 177740 | F | Ad. | 83 | Fatal Gun Shot |
| 1981 | 178620 | M | Ad. | 110 | Animal Control |
| 1987 | 179649 | M | 4 | 101 | Animal Control |
| 1987 | 179656 | F | Pup | 39 | Animal Control |
| 1987 | 179657 | M | Pup | 58 | Animal Control |
| 1987 | 179659 | F | 4 | -- | Trapped |
| 1988 | 179737 | M | 3 | 64 | Roadkill |
| 1989 | 179878 | M | 2 | 107 | Animal Control |
| 1989 | 179920 | F | Pup | 27 | Relocation/Starvation |
| 1989 | 179921 | F | Pup | 30 | Relocation/Starvation |
| 1989 | None | M | Ad. | -- | Illegal |
| 1989 | 179946 | M | 2 | -- | Unknown (B.C.) |
| 1990 | 180044 | F | 1 | 62 | Animal Control |
| 1990 | None | F | Ad. | -- | Relocated/Illegal |
| 1990 | None | M | Ad. | -- | Roadkill |
| 1991 | None | F | Ad. | -- | Illegal |
| 1991 | 180237 | M | Pup | -- | Natural |
| 1991 | None | F | 1 | -- | Animal Control |
| 1991 | 180255 | M | 1 | 96 | Illegal |
| 1991 | 180256 | F | 1 | 80 | Animal Control/Illegal? |
| 1992 | 180389 | M | 3 | 54 | Natural |

skull, the age and sex were determined. The physical characteristics from each carcass were measured, reproductive tracts and fetuses collected, the stomach contents analyzed, and general condition indexes developed. Many diseased or parasitized lions were examined to quantify the extent of these conditions.

Mountain Lion Morphology Study

Skull measurements taken from hunter killed lions included length and width. A total of 220 female and 451 male skulls were measured then aged by cementum annuli counts to examine skull growth in Montana mountain lions (Figs. 8 and 9). Mean skull length and width generally increased until age 4 or 5. There were significant differences in the juvenile, one- ,two-, and three-year old male lions. In females, only juvenile and lions over 1 year of age were distinguishable by skull length and width. Skull size may be an indicator of age in the lower age classes when growth is occurring.

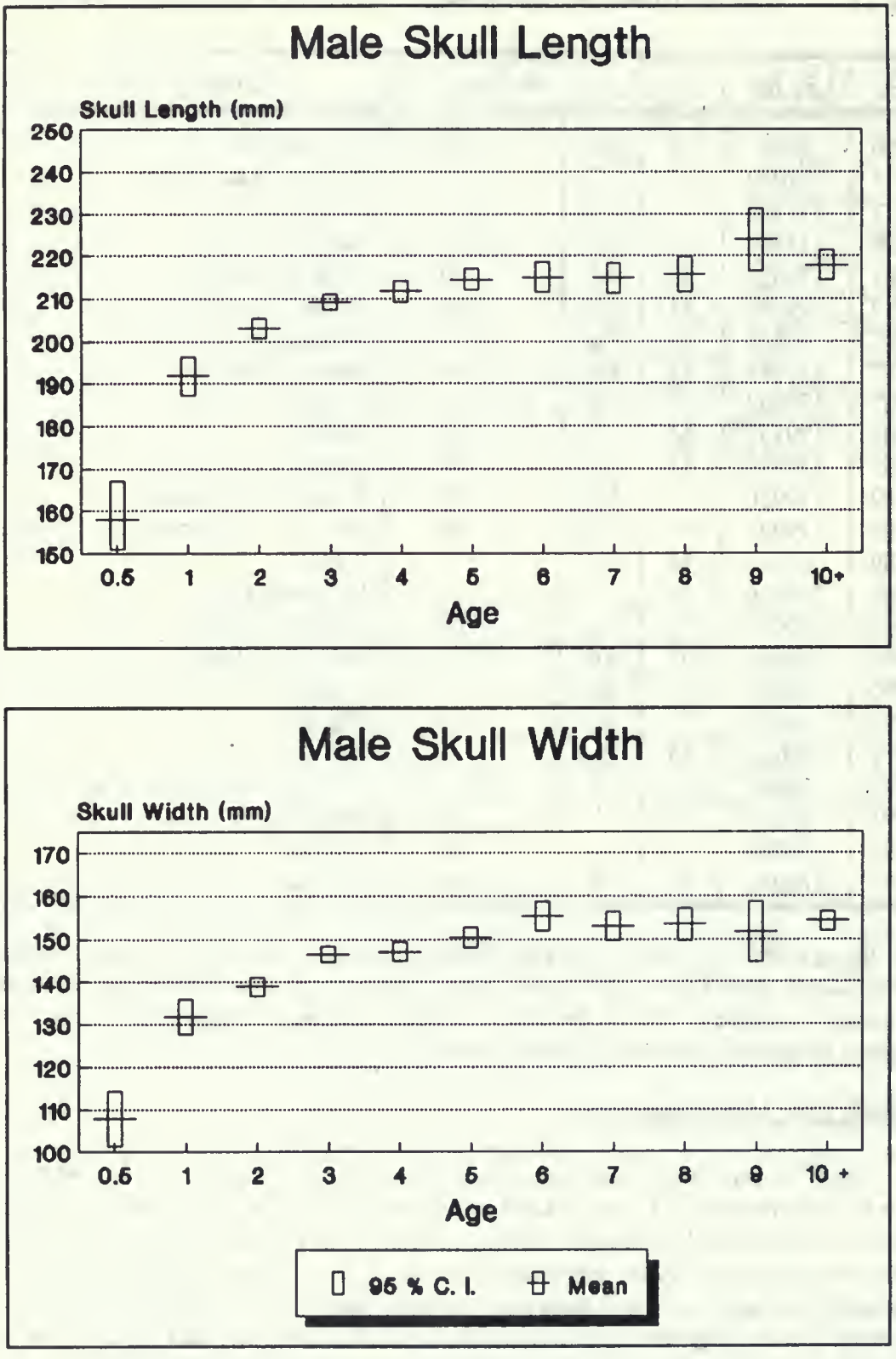


Figure 8. Skull characteristics of male mountain lions.

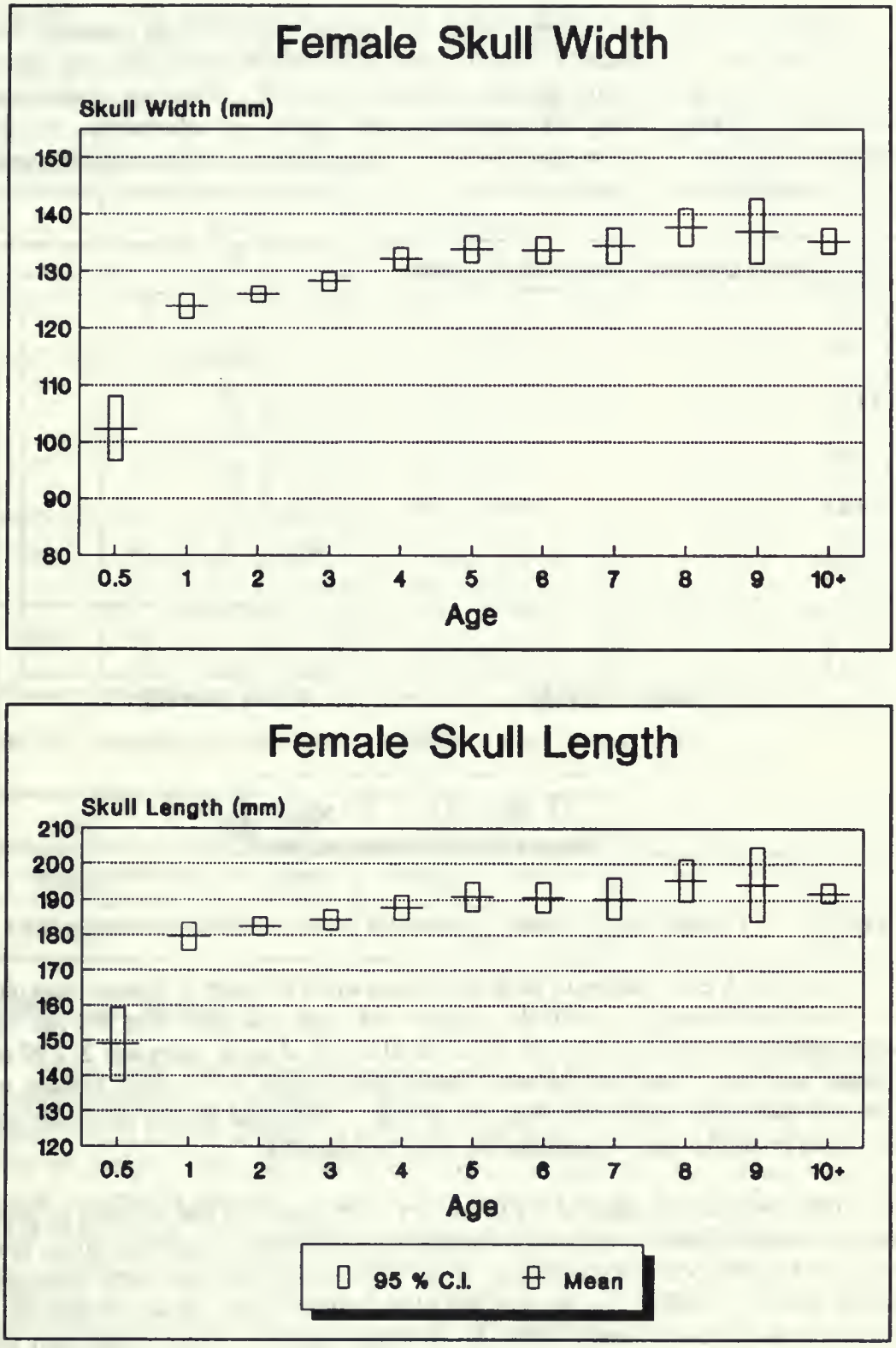


Figure 9. Skull characteristics of female mountain lions.

Canine diameter was measured from 205 female and 420 male mountain lions. Canine diameter was significantly ($P < 0.01$) different between sexes with male canines exceeding 13.5 mm and females less than 13.5 mm (Fig. 10). These data indicate that canine diameter could reliably sex mountain lions. With this information, we have examined all reported sexes and have found few discrepancies between reported sex and that indicated by canine diameter.

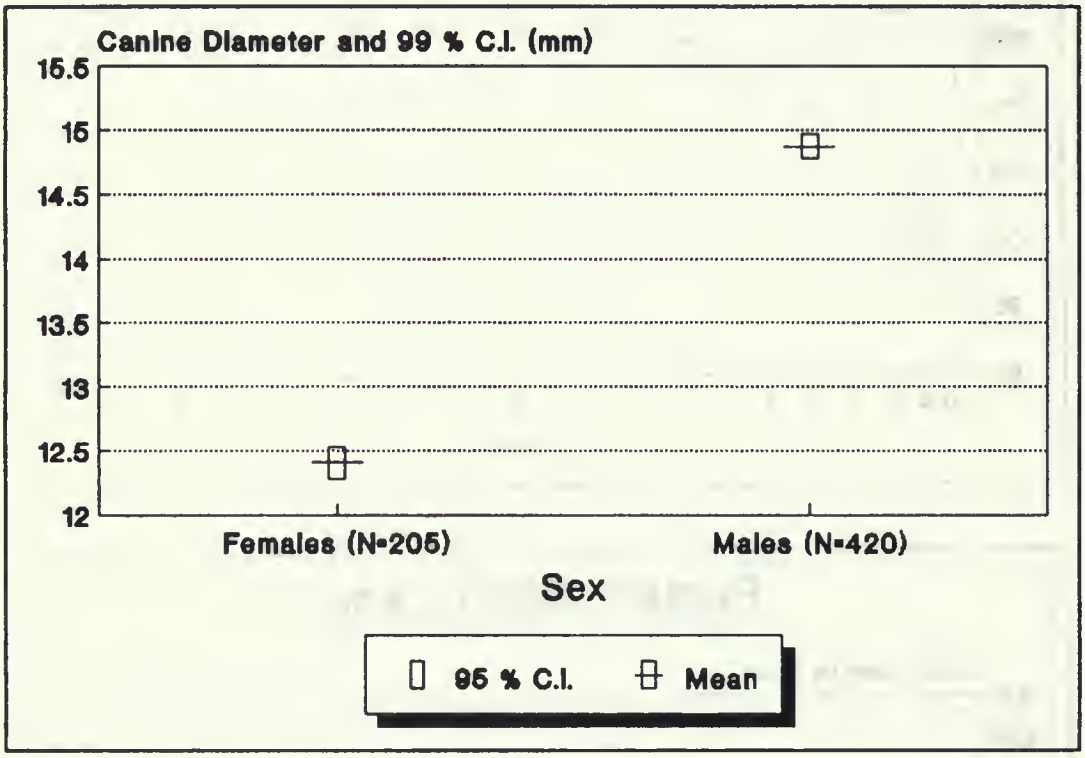


Figure 10. Comparison of canine diameter for male and female mountain lions.

An ANOVA examination of skull length and width for male or female lions older than 2 years (adult lions) by MDFWP regions indicated that skull size did not vary between regions ($P < 0.05$) (Table 14). Mean skull length of adult males was 212.62 mm and mean skull width was 149.56 mm. Mean skull length of all adult females was 188.78 mm and mean skull width was 132.46 mm. Male and female mountain lions appear to be of similar size throughout the State of Montana.

Lion carcasses examined in the laboratory were measured and weighed to gather detailed information about the physical characteristics of Montana mountain lions. Since a data collection protocol was developed, over 70 mountain lions have been examined. A simple matrix of weights by general age class indicates that sexual dimorphism is primarily evident in adult lions (Table 15). Further analysis is being undertaken with detailed analysis of physical characteristics by age.

Table 14. The mean length and width of adult male and female mountain lion skulls by each region in Montana, 1988-1992.

| Region | Sex | N | Mean Length | 95% C.I. | N | Mean Width | 95% C.I. |
|---|---|---|---|---|---|---|---|
| 1 | M | 142 | 212.6 | 210.9-214.2 | 141 | 149.8 | 148.2-151.4 |
| | F | 59 | 289.7 | 188.1-191.4 | 56 | 132.8 | 131.4-134.2 |
| 2 | M | 101 | 213.5 | 211.6-215.5 | 101 | 147.3 | 147.8-151.6 |
| | F | 37 | 189.1 | 187.1-191.2 | 36 | 132.5 | 130.8-134.2 |
| 3 | M | 41 | 213.5 | 210.4-216.6 | 35 | 150.0 | 146.8-153.2 |
| | F | 13 | 189.0 | 185.5-192.5 | 13 | 134.5 | 131.6-137.3 |
| 4 | M | 40 | 213.1 | 210.0-216.2 | 38 | 146.7 | 145.2-151.4 |
| | F | 18 | 187.4 | 184.5-190.4 | 18 | 130.5 | 128.1-132.9 |
| 5 | M | 31 | 208.1 | 204.5-211.6 | 31 | 149.6 | 145.9-152.8 |
| | F | 12 | 184.8 | 181.1-188.4 | 12 | 131.5 | 128.5-134.5 |
| Total | M | 355 | 212.6 | 211.6-213.7 | 346 | 149.6 | 148.5-150.6 |
| | F | 139 | 188.8 | 187.7-189.8 | 135 | 132.5 | 131.6-133.3 |

Table 15. Average weights (lbs.) of mountain lions by sex and age class.

| Sex | Birth (N) | Juvenile (N) | Sub-adult (N) | Adult (N) |
|---|---|---|---|---|
| Female | 1.27 (3) | 31.8 (6) | 69.0 (12) | 92.0 (11) |
| Male | - | 33.0 (7) | 73.2 (18) | 123.8 (13) |

Mountain Lion Reproduction

Since 1989, over 50 female reproductive tracts have been collected and fixed for detailed examination at a later date. Work is now progressing on these specimens. In addition, efforts have been made to collect fetuses from all pregnant female lions. These fetuses are weighed and measured to develop a fetal growth chart which will help in defining conception dates for pregnant lions collected in the future. Eighteen fetuses have been collected, and fourteen were measured from five litters of lions. An average of 3.6 fetuses were found in the reproductive tracts of these lions. Fetuses grew from a weight of less than 1 gram to a birth weight of over 500 grams. Further work is planned for detailing the reproductive activity of mountain lions from carcass collections and detailed results will be presented at a later date.

Age Determinations of Lions

Lions were aged by cementum annuli counts (Trainer and Matson 1988) and analysis of skull sutures (Greer unpublished data). Cementum annuli counts were checked against sixteen known aged lions in our sample (Table 16). Some discrepancies were noted, especially in lions older than 2 years of age. Skull measurements obtained for each lion indicated that in general, length and width were incrementally larger with increasing age. This evidence suggests that the premolar ages may be indicative of increasing age. In addition, age distributions from 1988-92 followed the expected pattern suggesting that these ages may be valid. Each year, we receive additional known aged lions, and the number of lions older than 2 years has been increasing. Further testing is needed to determine the accuracy of premolar cementum annuli counts for aging mountain lions.

Table 16. Comparison of known aged lions and cementum annuli counts.

| Lab No. | Known Age | Suture Class | Cementum Annuli | Sex |
|---|---|---|---|---|
| 180373 | 6-8 mo. | KI | 0A | M |
| 180380 | 6-8 mo. | KI | 0A | F |
| 5660 | 8-10 mo. | KI | 0A | M |
| 5688 | 8-10 mo. | | 1B | M |
| 5130 | 10-12 mo. | I | 2A | F |
| 5711 | 10-12 mo. | I | 2B | M |
| 5444 | 10-12 mo. | I | 1A | M |
| 180296 | 10-12 mo. | I | 1A | ? |
| 180299 | 10-12 mo. | I | 2B | F |
| 180456 | 12-14 mo. | I | 3B | M |
| 180352 | 17 mo. | | 4A | F |
| 4651 | 18 mo. | II | 2B | M |
| 180384 | 19 mo. | II | 3A | M |
| 3348 | 3 | III | 7B | M |
| 3353 | 6 | VI | 8B | F |
| 4182 | 7-8 | VII | 5B | F |

Mountain Lion Food Habits

Stomach contents were examined from 56 mountain lions. Twenty-six of these were involved in human conflict situations, and results from these are presented in another section of this report. Stomach contents from 30 mountain lions were examined to determine food habits of Montana mountain lions. Six of these lions had eaten primarily domestic livestock. The remaining 24 lions ate a varied diet consisting of elk, white-tailed deer, mule deer, moose, small mammals, and other. The number one food item for lions was white-tailed deer followed by elk and mule deer. Detailed analysis is being deferred until further collections have been made.

Lion Mortality Study

Total lion mortalities recorded for 1988-89, 1989-90, 1990-91, and 1991-92 were 164, 193, 258, and 276, respectively. The number of recorded non-hunting mortalities increased from 6 in 1988-89 to 39 in 1991-92 (Table 17). Self-defense cases, animal damage control, and nuisance lions added significantly to the number of nonhunting mortalities. A significant increase in the hunting mortalities occurred during 1990-91 and 1991-92 (Fig. 11). Regions 1, 2, 3, 4, and 5 reported similar or higher numbers of hunter kills during 1991-92 as compared to the previous year (Table 18). Regions 1 and 2 accounted for 61.8% of the 1988-89 mortalities, 69.9% of the 1989-90 mortalities, 65.9% of the 1990-91 mortalities, and 69.2% of the 1991-92 mortalities.

1991-92 Mountain Lion Harvest Age and Sex Structure

Hunting mortalities were 159, 168, 227, and 237 in 1988-89, 1989-90, 1990-91 and 1991-92, respectively. Aune (1991) has shown that the lion harvest has increased significantly and steadily from 50 lions in 1970-71 to over 200 in 1990-91 (Fig. 11). The harvest continued to increase in 1991-92. The sex ratio of the harvest was similar for all four seasons from 1988-1992 (Table 19). The proportion of females in the harvest has risen slightly. Harvest statistics were summarized for each hunting district in Montana (Table 20). Many districts showed significant increases in lion harvest over the four-year period.

The age structure of the statewide harvest has shifted upward steadily for the past four years (Fig. 12). Lions aged 3 and older increased while the number of lions aged 1 and 2 decreased over the four hunting seasons. The mean age of mountain lions in the harvest increased significantly ($P < 0.05$) from 1988-89 to 1991-92 (Fig. 13). Mean age rose from 3.1 in 1988-89 to 4.8 for 1991-92, while the median age rose from 3 to 4. There was no difference in the mean age of lions between regions for each of the four annual hunting seasons compared ($P < 0.05$). Mean age increased in 1991-92 in four regions and declined slightly in Region 3 (Fig. 14).

Table 17. Lion mortalities by mortality class, 1988-89 through 1991-92.

| Mortality Class | No. of Lions * | | | |
|---|---|---|---|---|
| | 1988-89 | 1989-90 | 1990-91 | 1991-92 |
| Accidental Snare | 2 | 3 | 1 | 2 |
| Animal Damage Control | 0 | 4 | 7 | 7 |
| Nuisance Control | 0 | 1 | 6 | 4 |
| Human Threat | 0 | 2 | 2 | 0 |
| Illegal | 0 | 2 | 1 | 0 |
| Dogs | 2 | 0 | 0 | 0 |
| Road Kill | 1 | 4 | 2 | 10 |
| Self Defense | 0 | 5 | 5 | 4 |
| Train | 0 | 1 | 1 | 1 |
| Natural | 0 | 2 | 5 | 6 |
| Unknown | 0 | 1 | 1 | 4 |
| Wounding | 0 | 0 | 0 | 1 |
| Subtotal | 5 | 25 | 31 | 39 |
| Hunting | | | | |
| Archery | 30 | 38 | 44 | 49 |
| Handgun | 69 | 71 | 94 | 84 |
| Rifle | 60 | 57 | 86 | 100 |
| Unknown | 0 | 2 | 3 | 4 |
| Subtotal | 159 | 168 | 227 | 237 |
| TOTAL | 164 | 193 | 258 | 276 |

* This is an updated version of results for these four years. Some changes have been made in data from previous years.

Table 18. Lion mortalities by MDFWP Regions, 1988-89 to 1991-92.

| Region | 1988-89 | | 1989-90 | | 1990-91 | | 1991-92 | |
|---|---|---|---|---|---|---|---|---|
| | Hunting | Nonhunting | Hunting | Nonhunting | Hunting | Nonhunting | Hunting | Nonhunting |
| 1 | 50 | 2 | 66 | 10 | 84 | 13 | 109 | 15 |
| 2 | 50 | 1 | 50 | 9 | 64 | 7 | 56 | 11 |
| 3 | 18 | 2 | 18 | 2 | 27 | 3 | 22 | 5 |
| 4 | 23 | 0 | 21 | 2 | 30 | 4 | 30 | 3 |
| 5 | 18 | 0 | 12 | 2 | 21 | 4 | 20 | 5 |
| 7 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |

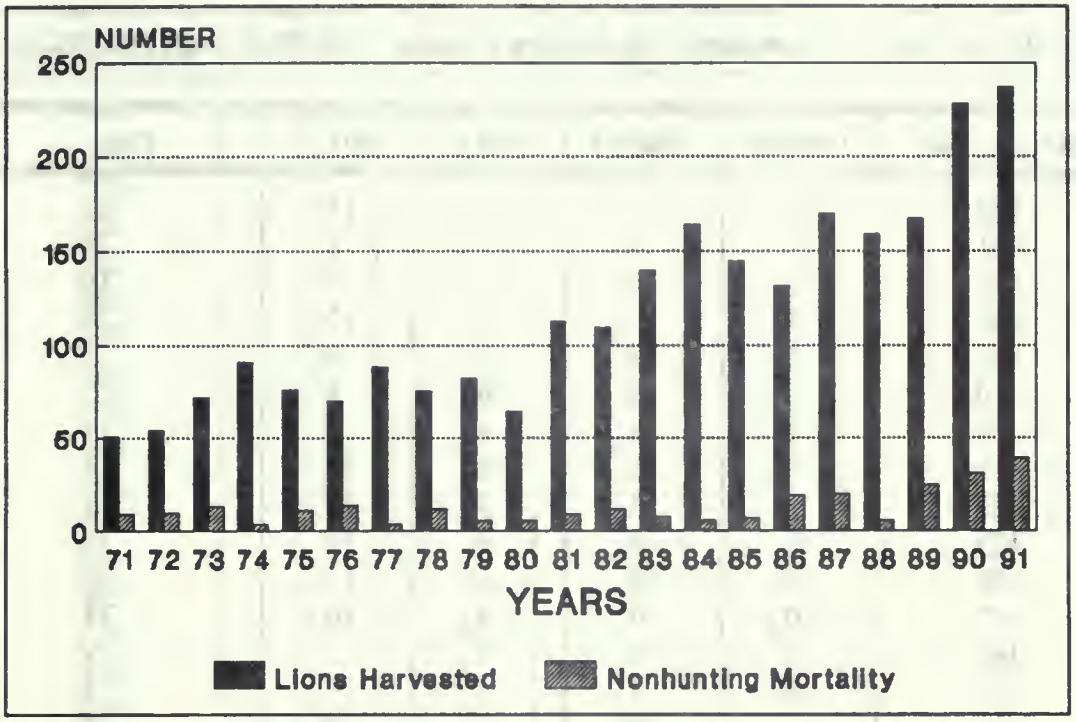


Figure 11. Mountain lion mortality trend, 1971-91.

Table 19. Sex ratios of harvested mountain lions, 1988-1991.

| Sex | Frequency | | | | Percentage | | | |
|---|---|---|---|---|---|---|---|---|
| | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1988-89 | 1989-90 | 1990-91 | 1991-92 |
| Males | 111 | 124 | 155 | 178 | 70.3 | 73.8 | 68.3 | 65.4 |
| Females | 47 | 44 | 72 | 94 | 29.7 | 26.2 | 31.7 | 34.6 |

Table 20. Mountain lion harvest by hunting districts, 1988-89 through 1991-92.

| Hunting Dist. | 1988-89 | 1989-90 | 1990-91 | 1991-92 | Total |
|---|---|---|---|---|---|
| 100 | 5 | 11 | 12 | 14 | 42 |
| 101 | 4 | 6 | 7 | 8 | 25 |
| 102 | 1 | 4 | 4 | 7 | 16 |
| 103 | 9 | 1 | 6 | 12 | 28 |
| 104 | 0 | 0 | 2 | 0 | 2 |
| 110 | 3 | 6 | 6 | 8 | 23 |
| 120 | 1 | 4 | 4 | 2 | 11 |
| 121 | 9 | 10 | 12 | 13 | 44 |
| 122 | 1 | 5 | 5 | 10 | 21 |
| 123 | 5 | 6 | 6 | 12 | 29 |
| 130 | 9 | 10 | 9 | 11 | 39 |
| 132 | 0 | 0 | 4 | 10 | 14 |
| 140 | 2 | 1 | 5 | 1 | 9 |
| 141 | 0 | 1 | 1 | 1 | 3 |
| 150 | 1 | 0 | 1 | 0 | 2 |
| 170 | 0 | 1 | 0 | 0 | 1 |
| 200 | 1 | 1 | 3 | 1 | 6 |
| 201 | 4 | 6 | 6 | 3 | 19 |
| 202 | 7 | 10 | 6 | 5 | 28 |
| 203 | 6 | 1 | 4 | 7 | 18 |
| 204 | 0 | 5 | 4 | 6 | 15 |
| 205 | 0 | 0 | 0 | 1 | 1 |
| 210 | 3 | 2 | 4 | 3 | 12 |
| 212 | 2 | 0 | 3 | 2 | 7 |
| 215 | 0 | 1 | 0 | 1 | 2 |
| 216 | 2 | 2 | 2 | 3 | 9 |
| 231 | 0 | 0 | 1 | 0 | 1 |
| 240 | 6 | 2 | 8 | 1 | 17 |
| 250 | 7 | 8 | 10 | 6 | 31 |
| 261 | 0 | 0 | 1 | 1 | 2 |
| 270 | 1 | 1 | 1 | 0 | 3 |
| 281 | 2 | 3 | 3 | 4 | 12 |
| 283 | 3 | 2 | 4 | 3 | 12 |
| 285 | 2 | 1 | 1 | 3 | 7 |
| 290 | 0 | 0 | 0 | 1 | 1 |
| 291 | 1 | 1 | 1 | 1 | 4 |
| 292 | 1 | 2 | 1 | 2 | 6 |
| 293 | 2 | 2 | 1 | 2 | 7 |

| Hunting Dist. | 1988-89 | 1989-90 | 1990-91 | 1991-92 | Total |
|---|---|---|---|---|---|
| 300 | 2 | 0 | 1 | 0 | 3 |
| 301 | 1 | 2 | 2 | 2 | 7 |
| 302 | 1 | 3 | 2 | 0 | 6 |
| 303 | 0 | 0 | 1 | 0 | 1 |
| 312 | 1 | 0 | 1 | 0 | 2 |
| 313 | 2 | 1 | 1 | 0 | 4 |
| 314 | 2 | 1 | 2 | 2 | 7 |
| 317 | 1 | 2 | 2 | 3 | 8 |
| 318 | 0 | 0 | 2 | 0 | 2 |
| 319 | 0 | 0 | 1 | 0 | 1 |
| 320 | 1 | 0 | 1 | 0 | 2 |
| 321 | 0 | 0 | 0 | 1 | 1 |
| 322 | 0 | 1 | 0 | 1 | 2 |
| 325 | 0 | 0 | 0 | 1 | 1 |
| 326 | 0 | 0 | 1 | 0 | 1 |
| 330 | 1 | 0 | 0 | 0 | 1 |
| 331 | 1 | 0 | 3 | 1 | 5 |
| 333 | 0 | 0 | 1 | 1 | 2 |
| 350 | 0 | 0 | 0 | 1 | 1 |
| 360 | 2 | 3 | 1 | 2 | 8 |
| 362 | 1 | 0 | 1 | 0 | 2 |
| 380 | 0 | 0 | 0 | 1 | 1 |
| 390 | 1 | 0 | 2 | 0 | 3 |
| 391 | 0 | 0 | 0 | 1 | 1 |
| 392 | 1 | 4 | 2 | 4 | 11 |
| 393 | 0 | 1 | 0 | 1 | 2 |

| Hunting Dist. | 1988-89 | 1989-90 | 1990-91 | 1991-92 | Total |
|---|---|---|---|---|---|
| 410 | 1 | 0 | 1 | 0 | 2 |
| 411 | 1 | 0 | 1 | 1 | 3 |
| 412 | 0 | 1 | 3 | 1 | 5 |
| 413 | 2 | 0 | 6 | 1 | 9 |
| 414 | 2 | 0 | 0 | 1 | 3 |
| 416 | 2 | 1 | 1 | 3 | 7 |
| 418 | 0 | 0 | 3 | 2 | 5 |
| 422 | 1 | 2 | 0 | 4 | 7 |
| 423 | 0 | 0 | 1 | 1 | 2 |
| 424 | 4 | 0 | 2 | 1 | 7 |
| 427 | 1 | 0 | 1 | 0 | 2 |
| 429 | 0 | 2 | 0 | 0 | 2 |
| 432 | 0 | 4 | 1 | 1 | 6 |
| 435 | 0 | 0 | 1 | 0 | 1 |
| 439 | 0 | 0 | 0 | 2 | 2 |
| 441 | 3 | 4 | 2 | 1 | 10 |
| 442 | 3 | 2 | 5 | 6 | 16 |
| 443 | 1 | 0 | 2 | 2 | 5 |
| 448 | 0 | 3 | 0 | 0 | 3 |
| 449 | 1 | 0 | 0 | 0 | 1 |
| 454 | 1 | 2 | 0 | 0 | 3 |
| 455 | 0 | 0 | 0 | 4 | 4 |
| 510 | 0 | 0 | 1 | 0 | 1 |
| 511 | 1 | 0 | 1 | 1 | 3 |
| 520 | 6 | 4 | 5 | 4 | 19 |
| 530 | 2 | 0 | 1 | 0 | 3 |
| 540 | 1 | 2 | 3 | 2 | 8 |
| 560 | 6 | 5 | 7 | 7 | 25 |
| 570 | 0 | 0 | 1 | 2 | 3 |
| 575 | 1 | 1 | 2 | 3 | 7 |
| 580 | 0 | 0 | 0 | 1 | 1 |
| 590 | 1 | 0 | 0 | 0 | 1 |
| 702 | 0 | 0 | 1 | 0 | 1 |
| 704 | 0 | 1 | 0 | 0 | 1 |

* Significant modifications were made in this table compared to last years table of results.

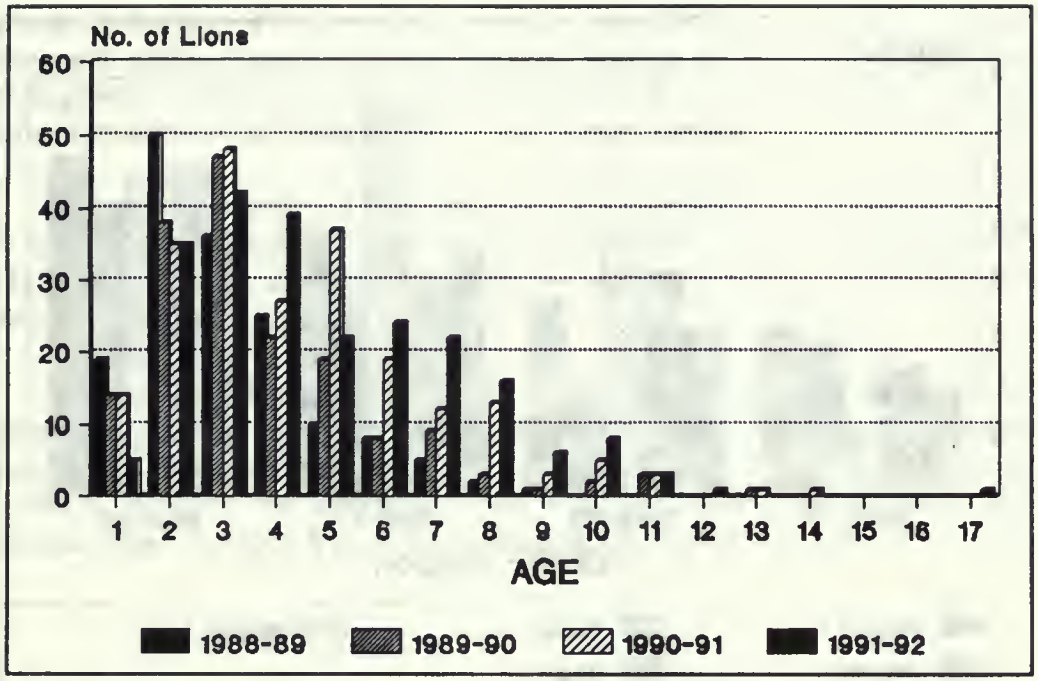


Figure 12. Age structure of the mountain lion harvest, 1988-91.

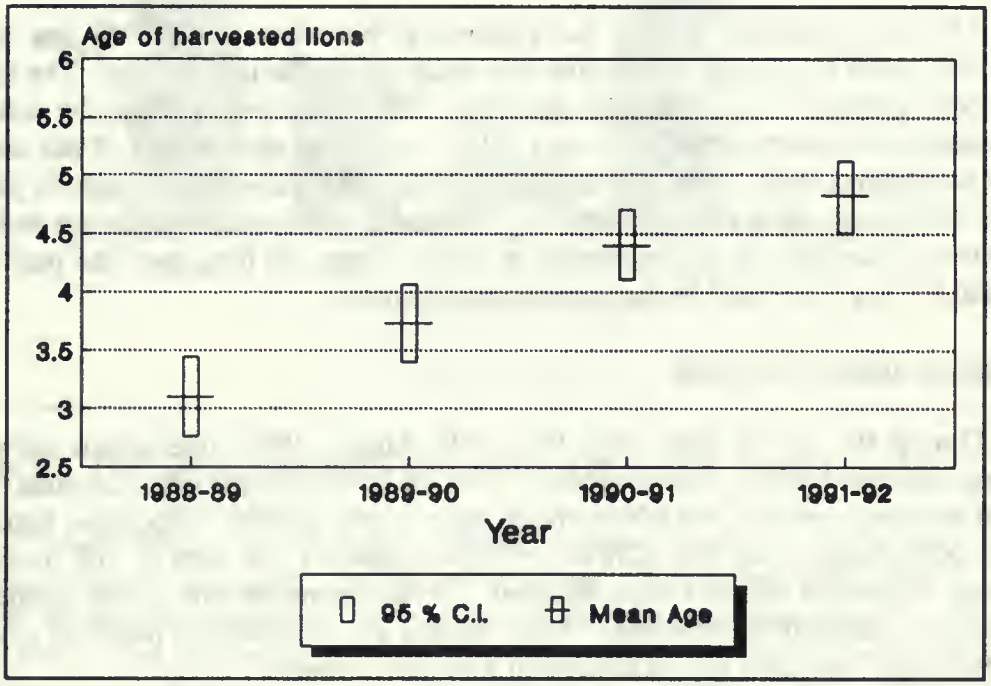


Figure 13. The mean age and 95% confidence interval of harvested mountain lions during 1988-1991

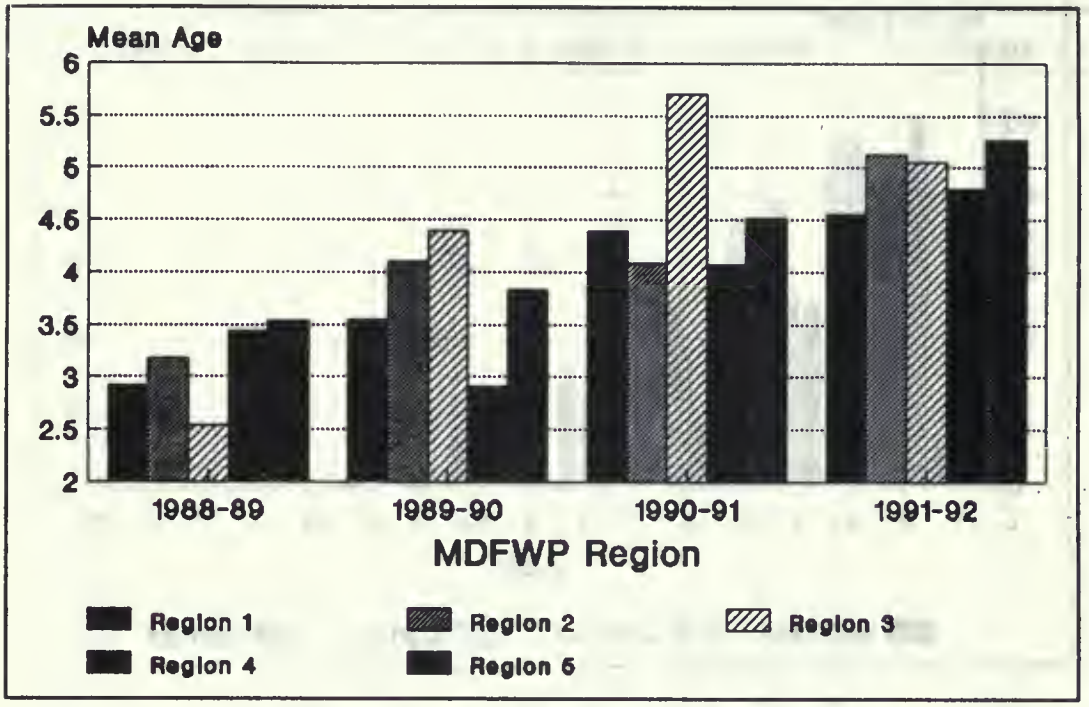


Figure 14. The mean age of mountain lions by region, 1988-91.

The data examined indicate that a cohort of lions born in 1987-88 has had a significant impact on the age distribution and mean age of the lion harvest. The affect of this cohort appears to be occurring statewide. This cohort may explain the pulse in lion incident activities reported by Aune (1991). The long term impact of this cohort on lion populations could be an increase in distribution of lions within the state as young lions recolonize previously empty habitats. Of interest and concern in the age and sex distributions is the decline in the number of 1 and 2 year old lions over the past four years and the slight increase in the proportion of females.

Human/Lion Interactions Study

During the period from July 1989 until August 1992, interactions between mountain lions and humans were monitored. Records of interactions were compiled from regional newspaper articles, MDFWP written case reports, USFWS Disposition Reports, and necropsy reports from the MDFWP wildlife laboratory. A total of 102 incidents confirmed by wildlife officials were recorded. These reports did not include incidental sightings near homes or communities. Other reports were received by phone or written correspondence, but could not be confirmed by official reports.

Actions of the lions were classified as involving livestock attacks, pet attacks, nuisance situations, predatory/aggressive behavior toward humans, and human attacks. All human attacks required actual contact with the human and resulting injuries inflicted

by the cat on humans. Predatory/aggressive behavior exhibited toward humans involved charges and sneak approaches toward humans, clawing the air, and vocalizations. In these aggressive exhibits, no actual contact is made with the human involved. Nuisance situations involved lions frequently seen near homes, ranches, or communities.

A complete summary of previous lion incidents in Montana was compiled in May 1991 and has been published in the human-lion interactions symposium in Denver (Aune 1991). This project is ongoing, and results summarized represent a brief summary of more recent findings.

Thirty-six (35.3%) of the 102 incidents reported in this period were classified as livestock attacks (Fig. 15). Lions were captured, then relocated or killed in 18 (50%) livestock cases. Twenty-four of the cases (66.6%) involved sheep. Other reported incidents of mountain lion interactions with livestock included rabbits, goats, poultry, cattle, and horses. Livestock cases occurred mostly throughout the April-October period.

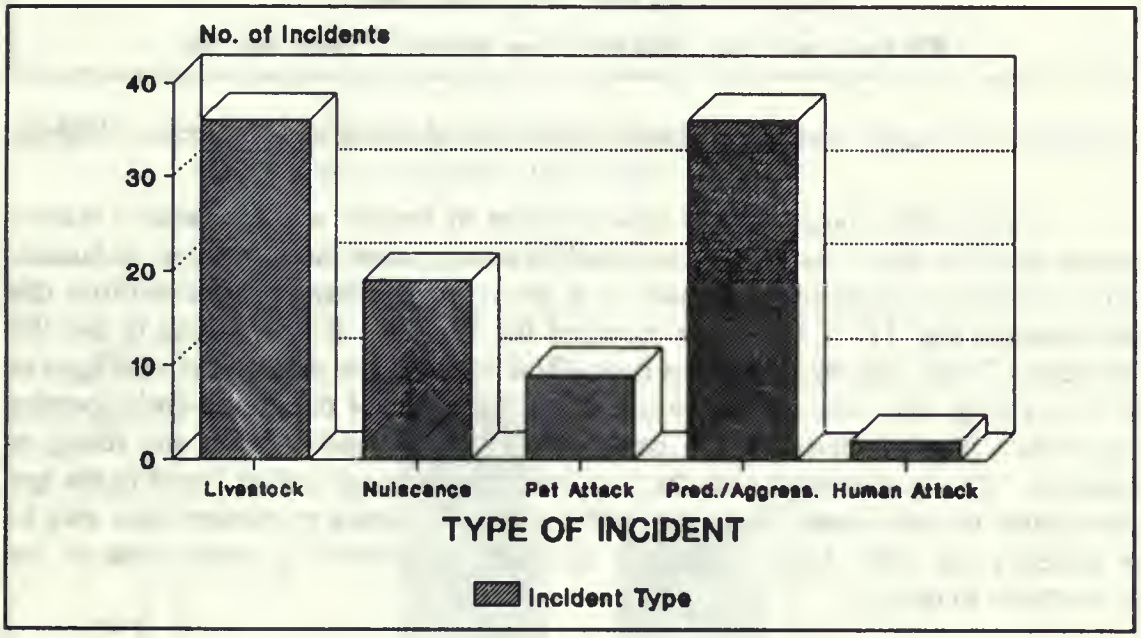


Figure 15. Frequency of mountain lion incidents by class in Montana, 1989-92.

Twenty-three incidents were reported in Fiscal Year 1990, 46 incidents were reported in Fiscal Year 1991, and 33 were reported in Fiscal Year 1992 (Fig. 16). The number of aggressive/predatory encounters reported has risen from 6 in FY1990 to 16 in FY1992. The number of incidents reported in 1992 was slightly higher than from previous years in Regions 2 and 4. The number of incidents declined in Regions 1, 3, and 5 as compared to the previous year. Livestock-lion interaction is more consistent in Regions 4 and 5 while human-lion interactions occurred more frequently in Regions 1 and 2.

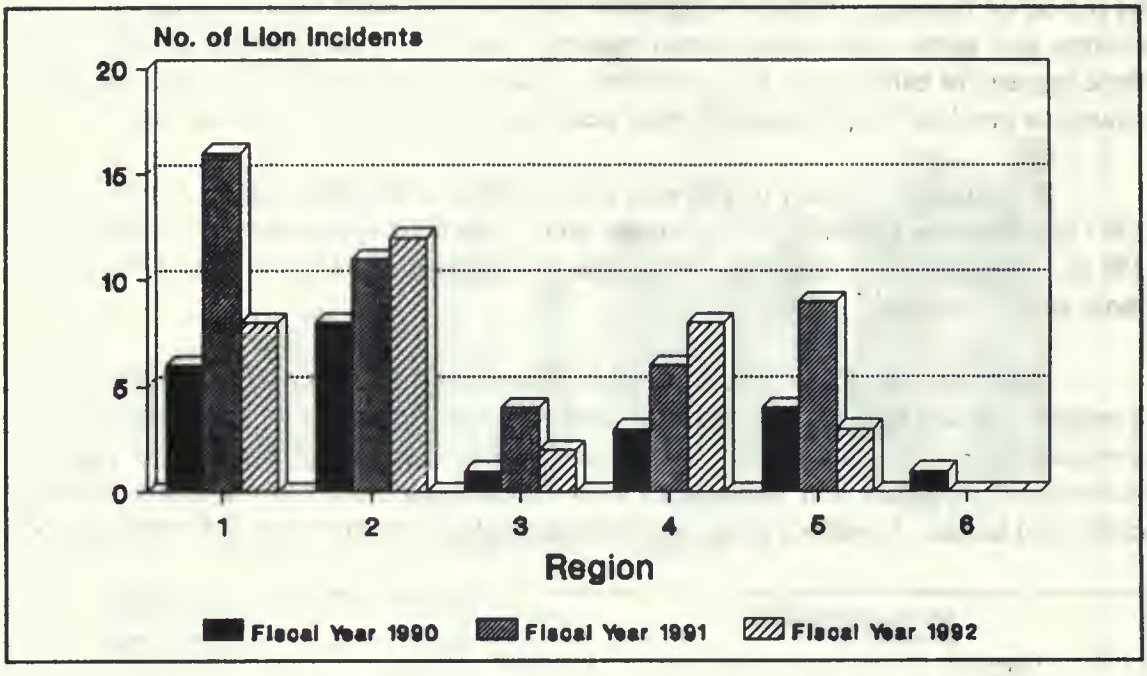


Figure 16. Comparison of reported lion incidents in Montana by fiscal years, 1990-92.

Aune (1991) found that the ratio of males to females was consistently skewed toward males in livestock-lion interaction while females were more prevalent in human-lion interactions. Continued examination of sex ratios in offending lions confirms this observation (Fig. 17) Ages were recorded for 50 of the lions involved in the 102 incidents. Thirty-one (62.0%) of the lions whose age could be determined were aged as 2 or less (Fig. 18). Aune (1991) hypothesized that most of the lions were dispersing subadults. Further investigations confirm that most offending lions are young or subadult. This is consistent with the impulse of a strong age cohort found in the age distribution of the harvest. However, with the possibly ageing population there may be a tendency for older lions to become increasingly involved in interactions or for interactions to decline.

Mountain lions actions reported to MDFWP by the APHIS/ADC has increased since 1967 (Fig. 19). A significant and continuous need for field actions occurred since 1983. Prior to 1983 APHIS/ADC records of depredation actions were infrequent.

Stomach contents were examined from 35 mountain lions involved in human/lion interactions. Twelve stomachs were empty. Eight lions fed upon domesticated pets including cats and dogs, three on domestic livestock, ten on white-tailed deer, and one on an elk. One lion stomach contained only cloth and debris. Lions which had fed upon anthropogenic food resources comprised 69% of those lions involved in human/lion interactions. Of nine lions involved in livestock depredations, only three had stomach contents revealing recent evidence of the infraction.

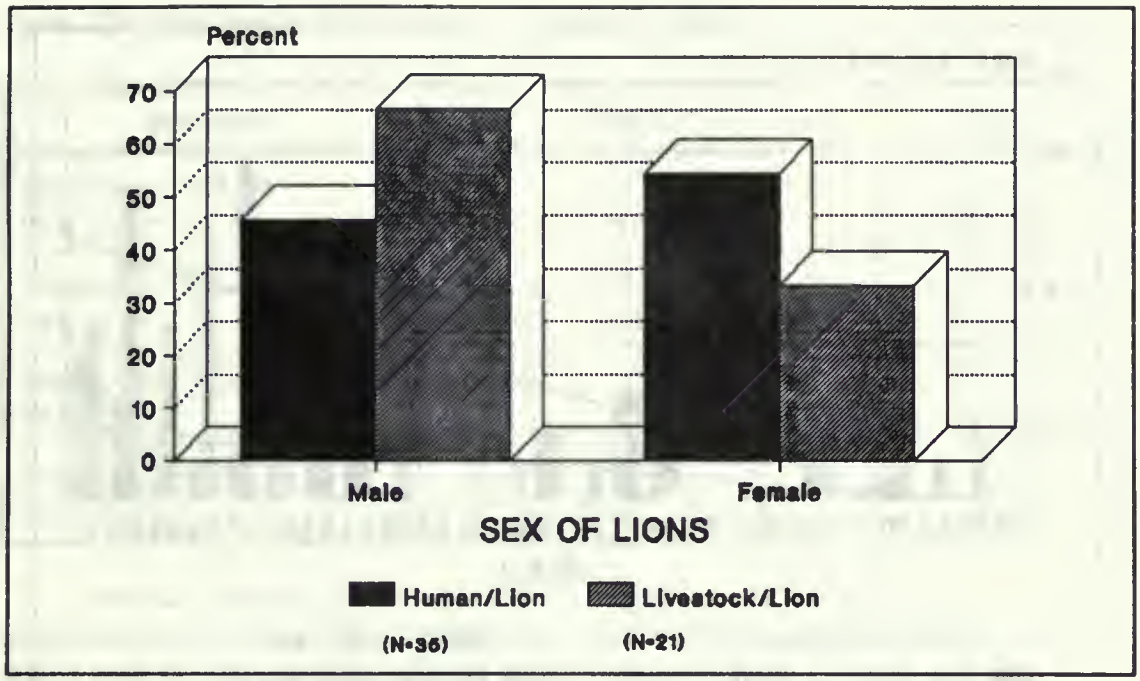


Figure 17. Sex ratio of mountain lions involved in human-lion and livestock-lion interactions in Montana, 1989-1992.

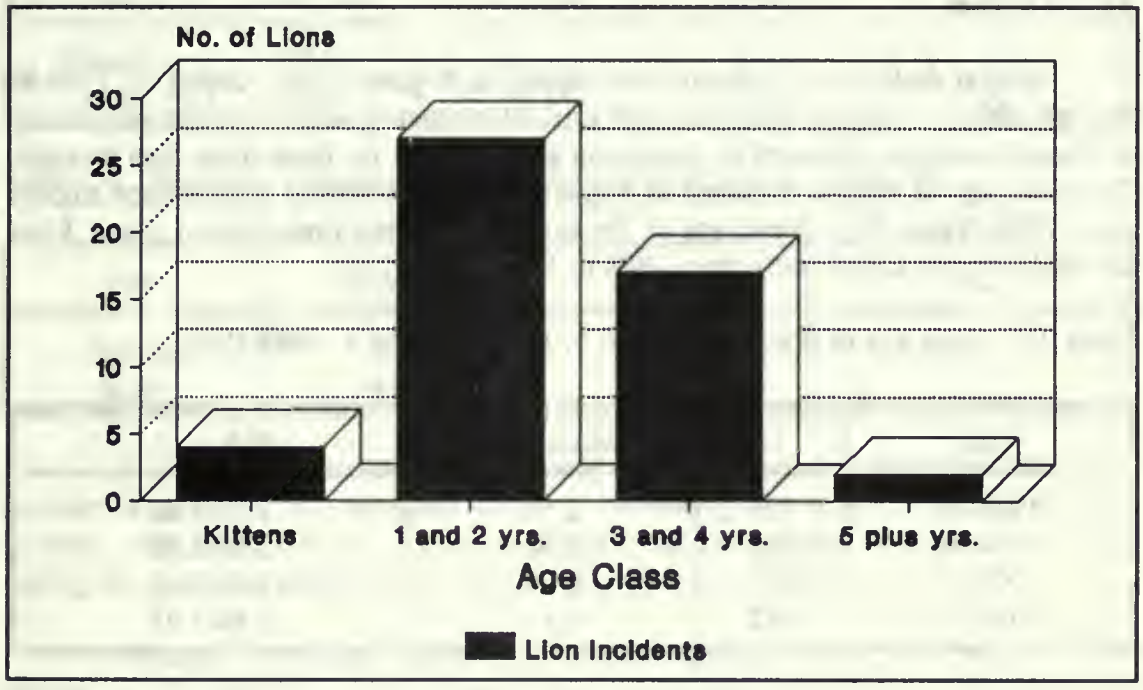


Figure 18. Age class of lions involved in all incidents in Montana, 1989-92.

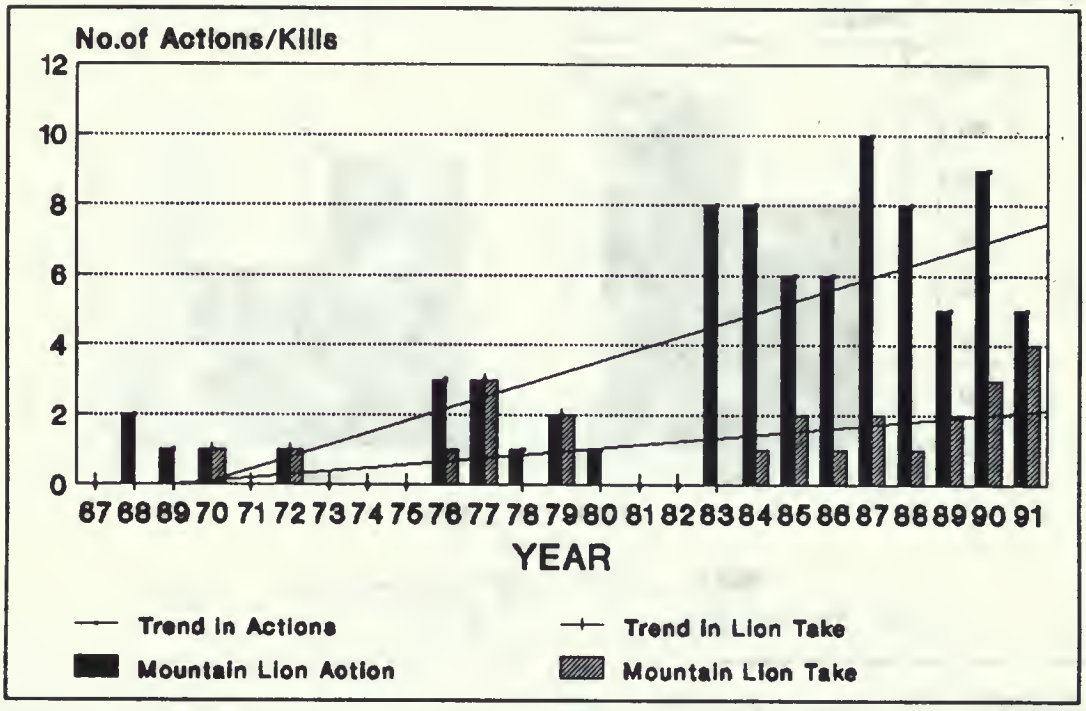


Figure 19. APHIS/ADC mountain lion depredation actions in Montana, 1967-91.

Bobcat Studies

Bobcat skulls were collected from trappers in Regions 2 and 3 during the 1988-89 through 1991-92 trapping seasons. Age was determined by examining the pulp cavity to discern juveniles, followed by cementum annuli counts for those older than juvenile. The mean age of bobcats collected in Regions 2 and 3 combined has declined slightly since 1988 (Table 21). Mean age of the bobcats collected from Region 2 and 3 has declined, but not significantly from 1988 to 1991 (Table 22).

Table 21. Mean age of bobcats collected in Regions 2 and 3, 1988-1991.

| Year | N | Mean Age | 95% C. I. |
|---|---|---|---|
| 1988-89 | 129 | 2.50 | 2.12-2.88 |
| 1989-90 | 106 | 2.48 | 2.06-2.90 |
| 1990-91 | 68 | 2.09 | 1.57-2.61 |
| 1991-92 | 182 | 2.14 | 1.84-2.45 |

Table 22. Mean age of bobcats by year and region, 1988-1991.

| Parameter | N | Region 2 | N | Region 3 |
|---|---|---|---|---|
| Mean Age 1988-89<br>95% C.I. | 25 | 2.22<br>1.31-3.13 | 41 | 2.60<br>1.89-3.31 |
| Mean Age 1989-90<br>95% C.I. | 83 | 2.54<br>2.08-2.96 | 20 | 2.10<br>1.21-2.99 |
| Mean Age 1990-91<br>95% C.I. | 46 | 2.04<br>1.43-2.65 | 17 | 2.44<br>1.63-3.25 |
| Mean Age 1991-92<br>95% C.I. | 64 | 2.20<br>1.69-2.72 | 72 | 1.92<br>1.48-2.35 |

Sex ratio of all bobcats harvested in Regions 2 and 3 combined did not differ significantly from 1988-1991 (Table 23). Sex ratio of bobcats harvested for the four-year period were not significantly different between Regions 2 and 3 (Table 24).

Table 23. Sex ratio of harvested bobcats in southwest Montana, 1988-1991.

| Sex | 1988-89 | 1989-90 | 1990-91 | 1991-92 |
|---|---|---|---|---|
| Female<br>Male | 50.0<br>50.0 | 40.8<br>59.2 | 41.5<br>58.5 | 43.3<br>56.7 |

Table 24. Sex ratio of harvested bobcats by MDFWP region, 1988-1991.

| Sex | Region 2 | Region 3 | Total |
|---|---|---|---|
| Female<br>Male | 38.6<br>60.8 | 43.3<br>56.7 | 42.4<br>57.2 |

An age distribution for Regions 2 and 3 combined was developed (Fig. 20). The number of juveniles has remained stable to increasing during the last four trapping seasons. The number of one-, two-, and three-year old bobcats has fluctuated widely during the four-year period. Few bobcats were aged over 9 years old.

A comparison of age distributions between Regions 2 and 3 was made for the harvest in 1991-92 (Fig. 21). There were significantly more 2-year old bobcats in Region 3 than Region 2.

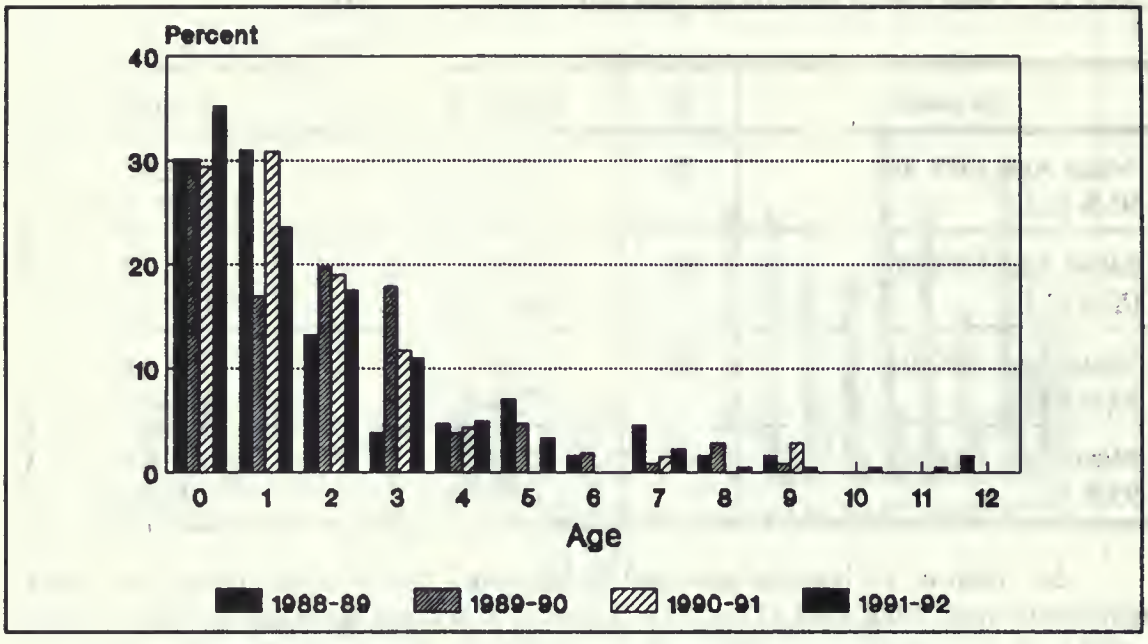


Figure 20. Comparison of bobcat age distributions for Regions 2 and 3 pooled, 1988-91.

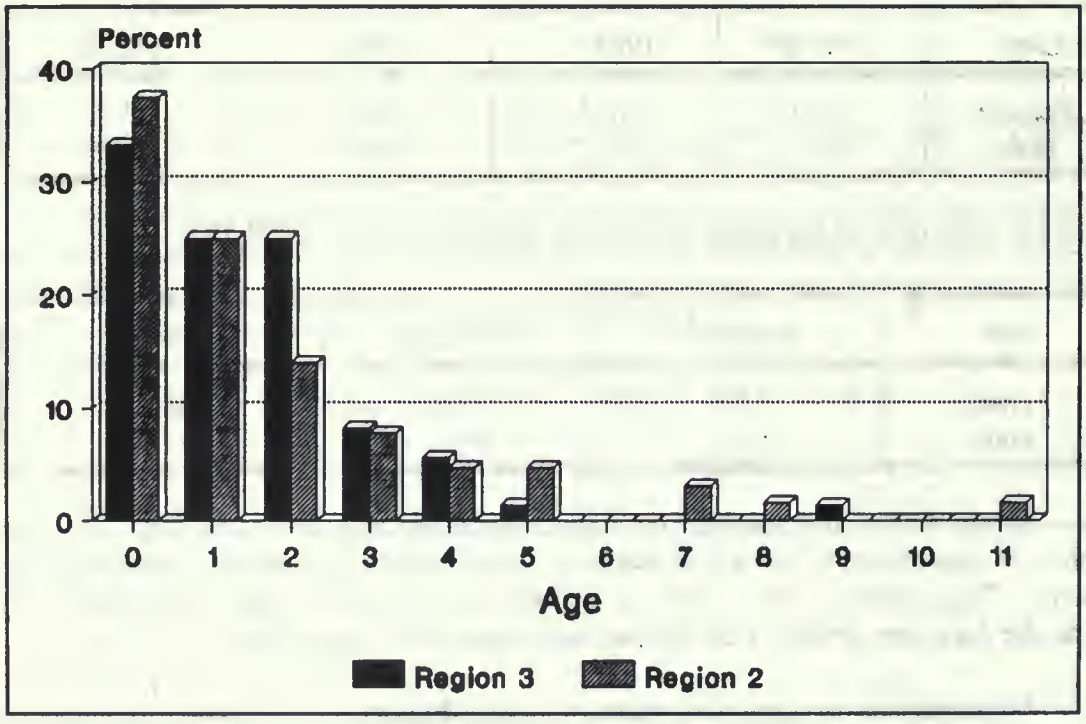


Figure 21. Comparison of the bobcat age distributions for regions 2 and 3, 1991-92.

The percentage of juveniles in Region 2 has increased from 24.0% in 1988 to 37.5% in 1991. The percentage of juveniles in Region 3 declined for three years from 36.6% to 17.6%, then rose recently to 33.3%.

## RECOMMENDATIONS

Wildlife laboratory services should continue. Sufficient flexibility should be maintained in order to be able to readily respond to changing needs of wildlife management and research biologists.

Work emphasis should be directed at building computer data files from large raw data compilations so that information is more readily available to biologists and managers. Computer-assisted data analysis should be continued in order to publish and distribute data on many topics of interest including mountain lion harvest data, food habits, reproductive performance of selected species, diseases and parasites of selected wildlife, and blood profiles.

Pine marten carcass collections should continue. However, the funding of this program must continue to be specifically directed to the laboratory so that budgeting and manpower planning can be more easily conducted.

The mountain lion trophy process should be modified to help speed processing of hunter-killed lions. A clear copy of the trophy form should be immediately sent to the laboratory as well as Helena and the regions so that processing can be conducted on each specimen immediately. Under the current process, the laboratory must wait for trophy forms to be transmitted from Helena Enforcement Division after they have completed their use of the forms. This delay prevents immediate processing and delivery of processed skulls until the trophy sheet arrives from Helena. The purchase of a vacuum packer would eliminate the need for skull cleaning before returning skulls to the owners. The use of a vacuum packer and x-ray will further shorten the protocol.

A bobcat skull collection process should be developed if additional regions participate in bobcat skull collections. The current situation results in many bobcat skulls with limited information as to the sex, location of kill, date of kill, or name and address of trapper. A tagging process similar to that used for mountain lions should be considered to assure correct tagging and reference marking of each specimen.

The establishment of a protocol for processing grizzly bear carcasses has the potential to greatly increase our knowledge of bears. All carcasses which can be reasonably obtained from the field should be immediately transported to the laboratory or frozen for later examination. A concerted effort by all regions involved will be necessary, and complete cooperation from field personnel will be essential. The potential exists for functional anatomy study and serious disease and parasitology studies with the materials available from the field.

Relocating grizzly bears to resolve human/bear conflict is frequently applied in both the Yellowstone and Northern Continental Divide Ecosystems. Record keeping in the NCDE is often unavailable for consistent review and analysis. It is recommended that copies of problem bear capture forms, flight reports, and interagency nuisance report forms from the NCDE be forwarded to the Wildlife Laboratory for filing and record keeping. Annual summaries of the information should be completed. This will provide accurate and long term record keeping of relocation efforts for review by grizzly bear managers.

Cooperative programs for disease surveillance should be promoted. Continued work in the collection of tissue from elk in the Gardiner, Gallatin and Madison areas should be continued one more year to increase sample size. Research projects handling captured wildlife should participated when possible in the statewide serological survey for microbial agents. A blood protocol is available from the laboratory and assistance in collection techniques can be obtained. Laboratory protocols should be developed to conduct routine fecal analysis and baermans for parasite investigations in cooperation with the Veterinary Molecular Biology Parasitology Laboratory.

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